JANUARY 1958
A Maclean-Hunter publication
five dollars a year

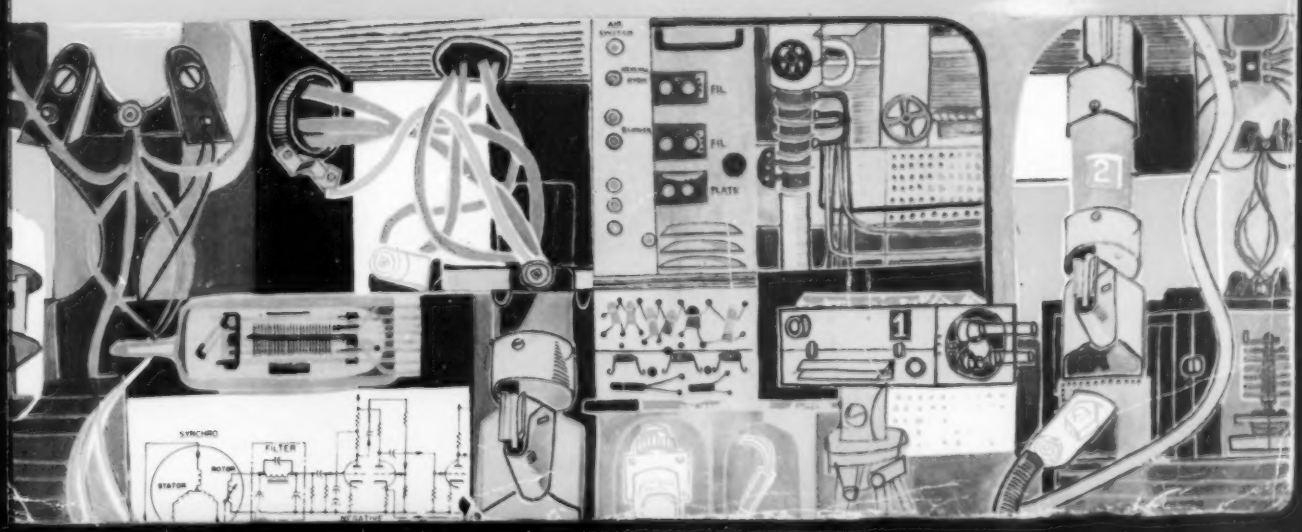
CANADIAN ELECTRONICS ENGINEERING

What's ahead in 1958?

NEW

INDUSTRY REVIEW & FORECAST

special report



THE BIRTH OF RADAR

According to an old Croatian fable, the first experimental radar station was installed 102,000 years ago last Thursday by a tribe of Cro-Magnons. But no sooner had the station been erected than a dinosaur appeared on the scene and gulped down everyone in sight—everyone but one badly frightened survivor.

"Tell the truth, man," the dinosaur said, "or I'll make Filet Cro-Magnon out of you. What is this mess of bones and stones you have here?"

"Ra-ra-radar," was the weak reply.

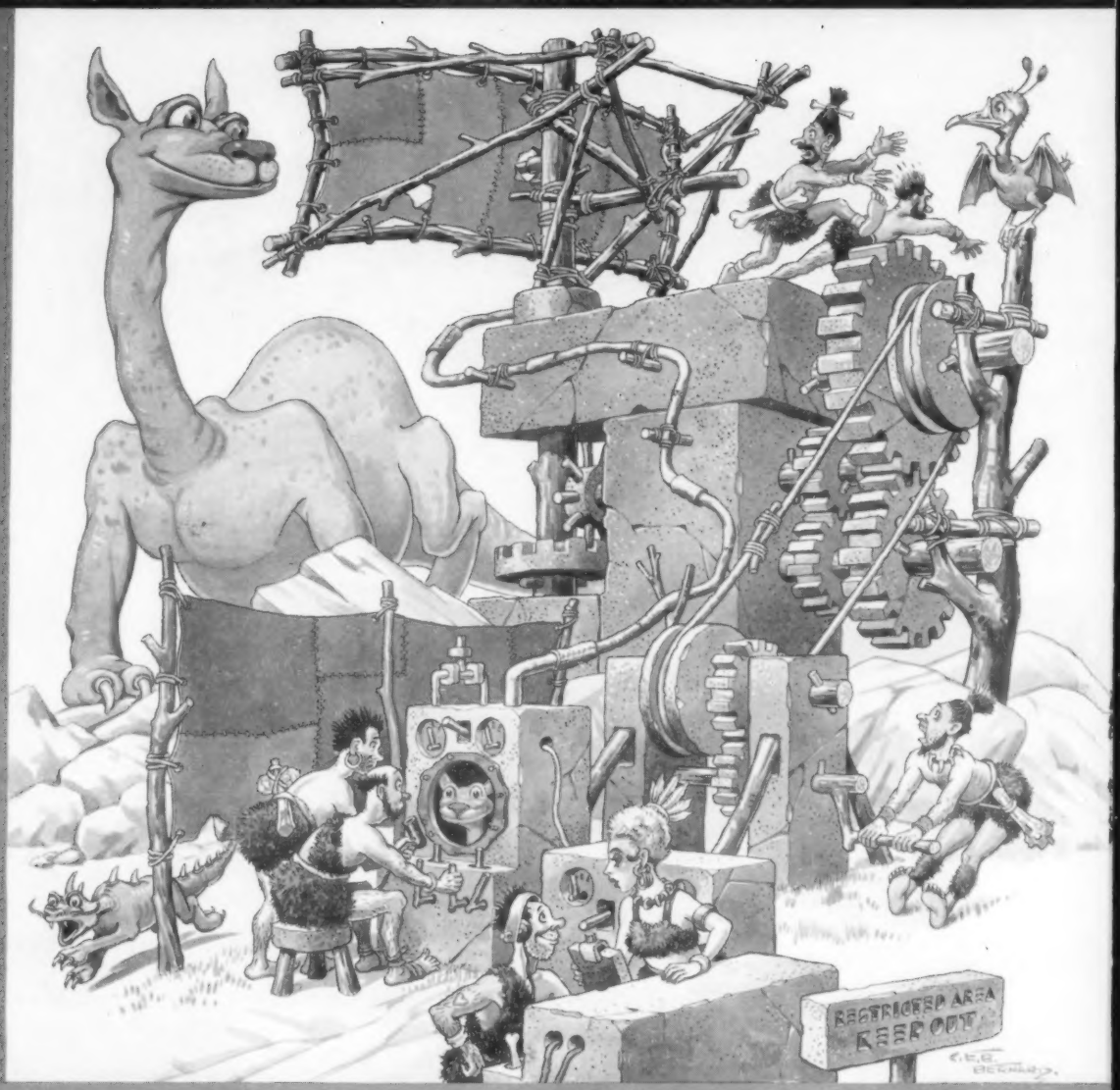
"Tell me another one," the dinosaur snorted. "If this is radar, I'm a ring-tailed brontosaurus. Does it use Bomac tubes?"*

"No . . . but . . ."

"That does it," the dinosaur said. "Whoever heard of a radar set without Bomac tubes?" He opened his mouth wide.

"Whoever heard of a talking dinosaur?" the man asked. But he was too far inside the dinosaur to hear the answer.

No. 1 of a series . . . BOMAC LOOKS AT RADAR THROUGH THE AGES



* *Bomac makes the finest microwave tubes and components since the birth of radar*

Bomac LABORATORIES, INC.,
Salem Road, Beverly, Massachusetts

Leaders in the design, development and manufacture of TR, ATR, Pre-TR tubes; shutters; reference cavities; hydrogen thyratrons; silicon diodes; magnetrons; klystrons; duplexers; pressurizing windows; noise source tubes; high frequency triode oscillators; surge protectors.

Offices in major cities—Chicago • Kansas City • Los Angeles • Dallas • Dayton • Washington • Seattle • San Francisco • Toronto • **Export:** Maurice I. Parisier, 1860 Broadway, New York City.

Canadian Representative: R.O.R. Associates, Ltd., 1470 Don Mills Road, Don Mills, Ontario.

January 1958

Volume two, number 1

CANADIAN ELECTRONICS ENGINEERING

Departments:

***Our cover design:** *Artist Frank Newfeld suggests readers might like to sort out the electronic components in his colorful design*

CANADIAN
ELECTRONICS
ENGINEERING

contributors and special articles in this issue:

Work on this month's special **Industry Review & Forecast** began months ago with a conference of CEE's editors. At first it looked as if the industry was fairly well documented but on closer examination the gaps began to appear.

Even "The Electronics Industry in Canada," the special report for the Royal Commission, admits the problems of separating electronics from electrical. This report only goes up to 1955 and a number of their projected figures have proved somewhat off the mark.

Visits to Ottawa, long talks with government and departmental heads, helped to fill in a lot of the gaps. Statistics, copies of reports and speeches descended in great quantities and from them digests were prepared.

Every firm connected in any way with the electronics industry in Canada was asked to help with the issue. The response was outstanding—with the usual last-minute rush providing an editorial headache.

So contributors to this special issue number hundreds. They have helped to make it a full and most up-to-date review of the industry.

Bachynski

Short wave propagation problems have been the main interest of **Morrel Bachynski** (Mountains increase radio reception) since he joined RCA Victor Research Laboratories, Montreal, towards the end of 1955.

He was born in Bienfait, Saskatchewan. The BE degree in engineering physics (1952) and the MSc (1953) both came from the University of Saskatchewan and the PhD from McGill University in 1955. Until joining RCA Victor he was a member of the staff of the Eaton Electronics Research Laboratory, McGill University, engaged in investigations of aberrations in microwave lens systems.

Robert Tanner (Special ceiling design helps solve main acoustical problems) has just been awarded a fellowship in the Institute of Radio Engineers for "his contributions in the design and application of audio equipment in the broadcast field." This is the only Canadian fellowship awarded this year.

Tanner: New fellow in the IRE

Bob Tanner gained a B.Sc. in engineering from the University of London (England) and came to Canada in 1947 after a number of years in the research department of the BBC and in the British Army. Since coming to Canada he has been with the Northern Electric Company and is in charge of their Electronics Development Department in Belleville. He has acted as an acoustical consultant on a number of important Canadian buildings.

a Maclean-Hunter publication

Authorized as second class mail, Post Office Department, Ottawa.

Printed and published by Maclean-Hunter Publishing Company Limited. Editorial and Advertising Offices: 212 King Street West, Toronto 2, Canada. Address all correspondence: P.O. Box 100, Toronto, Canada. Horace T. Hunter, Chairman of the Board; Floyd S. Chalmers, President; Donald F. Hunter, Vice-President and Managing Director; Thomas H. Howse, Vice-President and Comptroller.

Publishers of National Magazines in Canada: Maclean's, Chatelaine, Canadian Homes and Gardens, Business newspapers in Canada: Canadian Hotel Review; Fountains in Canada; Heating and Plumbing Engineer; Bus and Truck Transport; Canadian Advertising; Cnadian Automotive Trade; Canadian Aviation; Canadian Electronics Engineering; Canadian Grocer; Canadian Machinery; Canadian Packaging; Canadian Paint and Varnish; Canadian Printer and Publisher; Canadian Shipping; Canadian Stationer; Civic Administration; Design Engineering; Drug Merchandising; L'Epicier; The Financial Post; Hardware and Metal; Marketing; Men's Wear; Modern Power; Painting and Decorating; Plant Administration; Le Quincaillier; Electrical Contractor; Style; Office Equipment & Methods; Home Goods Retailing; Photo Trade; Building Supply Dealer; Business newspapers in U. S. and U. K.: Inland Printer, Rock Products, Concrete Products, British Printer.

OTHER SERVICES: The Financial Post Corporation Service; Canadian Press Clipping Service; Commercial Printing Division.

Offices at 1242 Peel Street, Montreal; Room 1004, The Bentrard Bldg., 1030, West Georgia Street, Vancouver 5, B.C.; Maclean-Hunter Limited, 125 Strand, London (Eng.).

Subscription rates: Canada $5.00 per year, two years $9.00, three years $13.00. Single copy price $1.00.

U.S.A., United Kingdom, $10.00 per year; all other countries, $20.00 per year.

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–sizes,
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accuracy,
damping,
to meet your special needs!

This comprehensive group of Weston d-c and rectifier type a-c panel meters provides not only increased scale readability, but higher accuracies and improved sensitivities and ballistic characteristics as well. Available in 2½″ — 3½″ — 4½″ and 5½″ sizes, in standard flanged and aircraft cases for a wide range of voltage and current indications, as well as for tachometry and temperature applications. All movements embody Weston springbacked jewels, and are magnetically self-shielded permitting their use interchangeably on magnetic or non-magnetic panels. For the complete story write to Daystrom Limited, 840 Caledonia Road, Toronto, Ontario; 5430 Ferrier Street, Montreal, Quebec, a subsidiary of Daystrom, Incorporated. Or any office of Northern Electric Co. Ltd.

5720

A DAYSTROM UNIT

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News highlights . . .

Anti-ICBM radar . . .
Main object of the new radar installation in the Prince Albert area of Northern Saskatchewan is for research into anti-ICBM early-warning field. Over 3,000 miles equipment could use meteorite reflection system, as in Janet, and electronic scanning antennas using a pattern of ferrite rods. DRB, Ottawa, announce: This will be the largest radar station ever constructed.

Boom for stereo . . .?
Increasing interest, wider popularity for stereophonic sound means stereo equipment will take a bigger chunk of the expanding hi-fi market says a Canadian manufacturer. He reports: The average buyer is willing to pay the price differential.

CBC in control . . .
Ottawa pressure groups want this Government to relax the CBC's control of TV and radio station planning. Their argument: Restricted competition, particularly in TV, would do everyone including the CBC, a lot of good. On the green light independent stations would probably go up in Toronto, Montreal and Quebec.

TV sales war . . .
Canadian TV retailers, already fighting a tough price-cutting war among themselves, are anxiously watching a new sales move in the States. One manufacturer is selling through independent TV technicians; no financial investment or volume quotas are required.

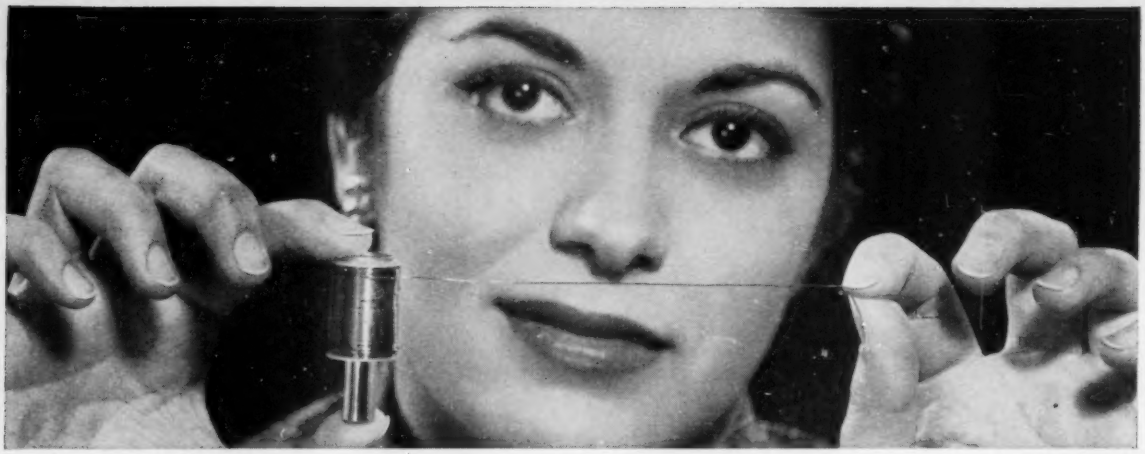
Ryerson in front . . .
Toronto's Ryerson Institute of Technology, who already put out a regular FM program during term, begin work on a UHF transmitter this spring. Transmissions are scheduled for late 1959; by 1960 students could be on the air with color TV.

Canadian-built Doppler . . .
Verdict after a top-level evaluation test on a new Canadian-built Doppler navigational radar system: looks pretty good. Project was undertaken with DRB by Canadian Marconi. Computing Devices of Canada designed a Position and Homing Indicator; Spartan Air Services sent up the plane.

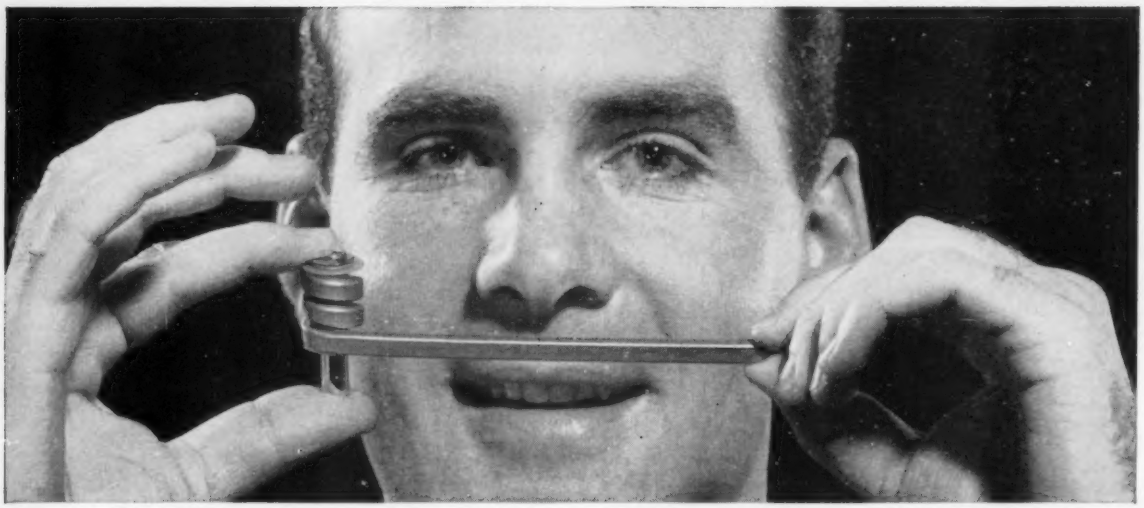
RETMA news . . .
The 13th Annual Meeting of the Canadian Radio Technical Planning Board was held in Ottawa on December 10. Elected president was F. H. R. Pounsett, P.Eng., assistant general manager of Canadian Radio Manufacturing Corporation Ltd. Vice-president is C. J. Bridgland, P.Eng., general radio engineer, Canadian National Telegraphs, and R. A. Hackbusch, P.Eng., president, Hackbusch Electronics Ltd. is general co-ordinator. R. C. Poulter, P.Eng., director of education, Radio College of Canada is director of public relations; F. W. Radcliffe, general manager, Radio-Electronics-Television Manufacturers Association of Canada, secretary-treasurer.

Here's a bargain for post-Christmas shoppers! Full-colour charts showing Canadian Radio Frequency Allocations are available from the RETMA of Canada head office (200 St. Clair Ave. West, Toronto) at 75c each. Chart was prepared by the Canadian Radio Technical Planning Board in co-operation with the telecommunications division of DOT.

Raytheon Canada Limited, 61 Laurel Street East, Waterloo, Ontario, is new member of the Electronics Division of RETMA of Canada. Total membership in this division is now 32 — an all-time high. New member company manufactures radar and associated equipment. They supply the long range surveillance radar equipment (AASR) to be installed by DOT at 15 centres across Canada.



from 0.010 to 100 amperes with just a turn of the wire



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For this reason, Heinemann circuit breakers offer you tremendous flexibility in specifying overload and short circuit protection for your products. They are available with tiny ratings down to ten milliamperes; or higher ratings, up to 100 amperes. Included are odd and fractional ratings such as 0.20, 23 or 18.7 amperes.

In any rating, you have the choice of at least four different time-delay characteristics . . . or instantaneous trip. And Heinemann ratings are stable ratings . . . remain constant through any ambient temperature range.

With Heinemann, you can match protection precisely to the safe operating limits of any equipment.

A GREAT HELP TO ENGINEERS . . . the "Circuit Breaker Engineering Guide" is a valuable aid to anyone applying protection to electrical or electronic equipment Ask for Bulletin 201.

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Circuit breakers

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Northern Electric to strengthen research and development

Northern Electric Company, recognizing the importance of research and development work in the electronics industry, has taken steps to strengthen this part of their organization.

A. B. Hunt has been appointed general manager, research and development. Formerly general manager of the company's telephone contract division, Mr. Hunt has also served as manager of the electronics and communications equipment divisions.

Mr. Hunt was born in London, Ontario and received his engineering degree from the University of Toronto. In 1952 he served as president of RETMA of Canada.

F. F. Fulton succeeds Mr. Hunt as general manager of the telephone contract division. A native of Saint John, N.B., Mr. Fulton graduated from McGill University in electrical engineering. After serving with Northern Electric from 1927, he joined the Royal Canadian Corps of Signals in World War II. This culminated in his appointment as chief technical officer for the Canadian Army overseas with the rank of brigadier.

V. O. Marquez has been appointed general manager of the sales division. Born in Trinidad, Mr. Marquez joined Northern Electric in 1929 and has held a number of engineering and administrative positions since then.

Appointed vice-president engineering, at CDC

J. S. Parsons has been appointed vice-president (engineering) of Computing Devices of Canada Ltd. In this position he will be responsible for all engineering activities.

Joining Computing Devices six years ago, Mr. Parsons established the analog systems department, and became technical director and chief engineer. In 1953 he was elected a director of the company.

I. A. Mayson becomes manager of marketing

I. A. "Don" Mayson is now the manager of marketing for the Electronic Equipment & Tube Dept. of Canadian General Electric Co. Ltd.

After graduating from the University of Toronto, engineering physics, in 1950, Mr. Mayson spent two years with Canadian Arsenals Ltd. before joining CGE.

New directors for Inglis-English Electric

John Inglis Co. Ltd., and English Electric Co. of Canada Ltd., have appointed the following new directors and officers.

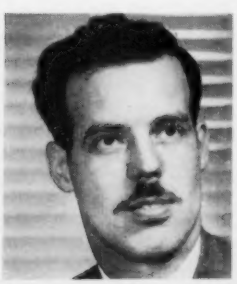
H. G. Nelson, managing director of the English Electric Co. Ltd., England, Mr. J. G. Notman, president of Canadair Ltd., and C. Emille Belanger, partner of Belanger, Saint-Jacques, Sirois et Cie, have been appointed to the board of directors.

W. A. Montgomery has been appointed a director and executive vice-president, and W. M. Hurton, executive director.

Other appointments and promotions

At Canadian Applied Research Ltd., P. G. Jeffrey, now director of sales and service will be responsible for the policy and administration of those two departments, W. D. Russell, a graduate of the University of Toronto and Osgoode Hall Law School, has been appointed as secretary and solicitor.

New manager for the Ottawa office of Adams Engineering Ltd., is J. M. Carriere. During the past 15 years he has been associated with the Canadian electronics industry with positions at N.R.C., RCAF, Dept. of National Defence (CAMESA) and Computing Devices of Canada.



Parsons

Mayson

Hunt

Canadian Marconi appointments

Hopkins

McCaughey

George

Daley

Winter

W. H. Hopkins, assist. gen. mgr. & sec.; A. G. McCaughey, comptroller & treasurer; W. V. George, assist. to the pres.; L. M. Daley, mgr. broadcast and TV receiver div., F. T. Winter, assist. mgr. commercial products div.

Guests honor inventor of the Audion

At their sixth annual meeting, the De Forest Pioneers honored the inventor of the Audion tube, Dr. Lee de Forest.

Present at the meeting were Madame Eugenia Farrar, who in 1907 became the first person to sing over the radio waves, and E. N. Pickerill, who on Aug. 4, 1910, was the first man to transmit and receive radio signals in an airplane in flight.

Westinghouse goes to Hall of Fame

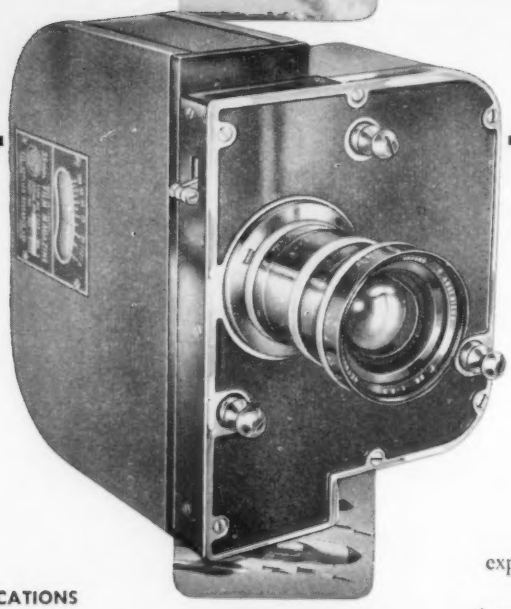
In the Hall of Fame for great Americans at New York University, a bronze bust of George Westinghouse was unveiled last month. This honor which places him in company with 81 other famous Americans, was bestowed because of his great contribution to the history and culture of the U.S.A.

Ham wins civil defence essay contest

W. M. Whitley, VE6BN, Edmonton has been awarded the prize for the best paper describing equipment and the role of the Ham in civil defence communications in Canada. The competition was sponsored by the Radio College of Canada in cooperation with the Civil Defence Division of the Government.

INSTRUMENTATION CAMERA

The Perfect Answer to Film Recording

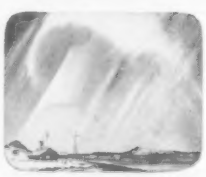


HERE is the perfect answer to the problems of film recording. The Mark 7 Instrumentation Camera is completely flexible through the entire field of instrumentation and aerial survey positioning photography. The shutter is a focal plane type, the basic exposure speed of which is 1/100 second. The camera may be cycled from 3 frames per second to any desired longer interval. Interchangeable apertures permit photographs of 18x25, 25x25 or 25x36 mm. A high degree of accuracy is achieved in respect to lens alignment, focusing and format positioning. Main components designed on the "module" system make conversion from one camera type to another relatively simple should customer requirements change. Write for literature and quotations.

SPECIFICATIONS

INSTRUMENTATION CAMERA
TYPE T232 Mk7

Size:	7½" x 5⅜" x 6½"
Weight:	13½ lbs.
Power:	28 volts DC; constant demand, .4 amperes; intermittent up to 1.8 amperes. The Type T232 DC power supply, which operates from 110v 60 cps, is available to power the camera
Lens:	28mm Augenieux F3.5, or to customer specification
Magazine:	100 ft. 35mm standard sprocketed film, No. 10 daylight loading spool. 400 ft. magazine available on special order
Picture Formats:	18x25, 25x25 or 25x36 mm.
Exposure:	1/100 second, or longer with intervalometer control
Interval Time:	3 cycles per second maximum



Canadian Applied Research Limited
(formerly PSC Applied Research Limited)

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MEMBER: A. V. ROE CANADA LIMITED & HAWKER SIDDELEY GROUP

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New Canadian company will make communications equipment

Expansion in the radio communications fields—estimates are for about 7,000 new stations this year — has brought a new company, Canadian Motorola Electronics Ltd., into existence.

The company, devoted solely to radio communications equipment, has now completed negotiation of a long-term agreement with Motorola Inc., Chicago, who make mobile, portable and microwave communications sets.

Directors of Canadian Motorola Electronics Ltd. are R. M. Brophy, L. C. Bonnycastle, B. H. Reiger and E. M. Auger of Toronto and Dr. D. E. Noble, executive vice-president, Motorola Inc., Chicago. Mr. Brophy, who was formerly board chairman of Rogers Majestic Electronics Ltd. and president of Philips Canadian Industrial Development Co. Ltd., is president. S. G. Paterson, formerly president of Rogers Majestic Electronics Ltd., is vice-president (sales) and E. M. Auger secretary-treasurer.

New premises are being constructed in North York, Toronto.

Westinghouse to step up capital spending

In the next two years Canadian Westinghouse Co. Ltd. will step up its capital spending to the rate of $5,000,000 annually, says George L. Wilcox, president of the company. Capital expenditure in 1957 totals about $3,500,000 and in 1956 $1,200,000. Net income for 1957 is expected to show a 12-15% rise over 1956.

More for telegraphs and cables

Telegraph and cables companies have been handling increasing loads during 1957 and their rate of expansion is expected to be as great as in 1956. Figures released by the Dominion Bureau of Statistics show that in that year earnings reached a new high of $6,784,000, some 9.7% over the previous record in 1955.

Operating revenues rose 3.6% to $40,720,000 and operating expenses climbed 3.7% to $33,689,000. This resulted in a 3% rise in net operating revenue to $7,031,000. Number of telegrams transmitted during the year was 20,382,000, an increase of 314,000 over the 1955 figure. Money transfers reached a new high of $24,295,000.

Sylvania to distribute Northern Electric appliances

Distribution of all major home appliances, radio and television sets now being marketed by Northern Electric Ltd. was taken over at the beginning of this year by Sylvania Electric (Canada) Ltd.

Drummond Brooks, active for more than 20 years in appliance merchandising, joins Sylvania as head of its new appliance and radio-TV division. He has been with Northern Electric since 1931, for the last five years as appliance-TV marketing manager.

Niedringhaus

Brooks

Announcement of the change was made jointly by R. E. Niedringhaus, president of Sylvania and F. F. Fulton, general manager of Northern Electric's sales division. Mr. Niedringhaus said dealers will carry Sylvania radio, TV and hi-fi sets as well as Leonard refrigerators, ranges, washers and dryers.

Quebec TV station wins national award

Station CKMI-TV, Quebec City, has been awarded the Station Representatives Association plaque for the "best station promotion during Canadian Television Week."

The competition was conducted by the TV sales division of the Canadian Association of Radio and Television Broadcasters. CKMI-TV is owned and operated by Television de Quebec (Canada) Ltd. Jean A. Pouliot is general manager and Arthur P. Fitzgibbons station and commercial manager.

New manufacturers agency formed

Ivor H. Nixon, who recently resigned from Pye Canada Ltd., has formed Tele-Radio Systems, a manufacturers agency offering electronic representation on behalf of U. S. and overseas principals. The new company is located in Toronto, Ont.

Left: Marty Howard, right G. E. Mohr, sales manager of Sealectro.

Canadian agents for Sealectro "Press-fit"

M. J. Howard & Co. of Ottawa have been appointed sales representatives by the Sealectro Corporation, Mamaronck, N.Y., for the entire Canadian market.

Marty Howard, who heads his own sales organization, has been in the electronic sales field for a considerable time.

Electro-Sonic Supply Co. Ltd., of Toronto, Ont., have been appointed Sealectro distributors.

Million dollar contract for Canadian Marconi

Biggest recent contract awarded in the electronics field by the Department of Defence Production has gone to the Canadian Marconi Co., Montreal, Que. It is for electronic equipment, valued at $1,100,919. A second contract was for $357,774.

Canadian Aviation Electric have also received contracts for $1,001,598 and $767,134. Other large contracts in the electronics field include: electronic tubes, Canadian Westinghouse Co. Ltd., $116,179 and $19,250, Canadian General Electric $80,117; Ahearn and Soper Co. Ltd., Ottawa, $40,360, Varian Associates of Canada Ltd., Georgetown, Ont., $37,526; electronic equipment, Canadian General Electric $513,000 (maintenance); Rogers Majestic Electronics Ltd., Toronto, $37,615.

News in brief

Electrodesign, Montreal, has been appointed Canadian representative by Control Electronics Company Inc., Huntington Station, N.Y.

Exclusive franchise in Canada for the products and services of Utility Tower Manufacturing and Fabricating Co. of Oklahoma, has been acquired by Pye Canada Ltd.

E. E. Whitaker, of Arnprior, Ont., now represents the Dressen-Barnes Corporation of Pasadena.

Simpson WIDE BAND LABORATORY OSCILLOSCOPE

Model 2610

Designed and produced in Canada for the Canadian market, the Model 2610 represents a new approach to precision oscilloscope engineering at a modest price.

Major improvements in long term stability, frequency response and ease of operation have been effected. Features 5% overall accuracy from D.C. to 6 Mc/sec. on the Y-Axis; or rolled off response providing 75 Millimicroseconds rise time on pulse waveforms with less than 3% overshoot. Free running time base from 3 c/sec. to 500 Kc/sec., or calibrated triggered sweeps as desired.

In either application synchronizing and triggering is remarkably effective at all usable signal amplitudes throughout the passband of the amplifier. Signal delay of 0.3 microseconds is provided switched in or out as desired. Flexibility as to internal or external blanking, triggering, etc., is provided by interlocking switches, while complete shielding prevents stray coupling and pulse distortion. Y Amplifier gain in excess of 2,000 x provides deflection sensitivity better than 3.3 Millivolts R.M.S./c.m. Employs twenty-five tubes, including flat faced 5" type C.R.T.

Price including cables and line cord — $550.00. Sales Tax extra.

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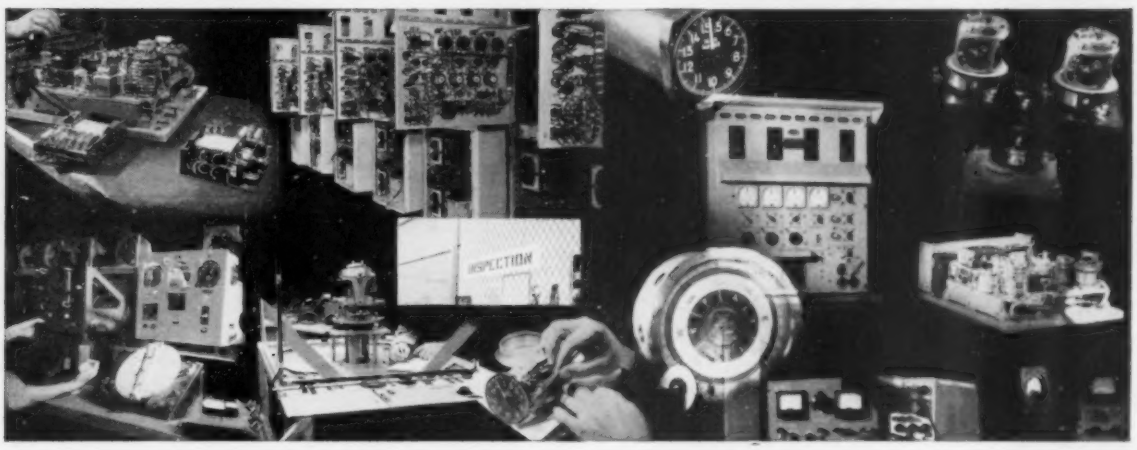
experience to plan

Long experience in solving problems relating to automatic control methods, places Sperry in a unique position to work with Canadian industry on projects involving new lines of research. To meet a critical need with a practical solution is part of the everyday work of the Company.
A specially trained staff of development engineers is always at your service.



ability to build

The modern Sperry plant was conceived, built and equipped as a complete unit. From the first day of its operation its full facilities were put into use and a natural flow of processes followed. This made possible an intensive supervision of every operation so that engineers might apply their skills to best advantage. The result of this is the ability to build with accuracy and precision and at costs within the framework of good business.

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Keeping in circulation?

We may not have the circulation problems of this young swain, but we too must keep our address book up-to-date. Your name is in it.

Once every year, the auditor from Canadian Circulations Audit Board Inc. checks our address records. If he checks your name, he will want proof of the business you are in, and that your address is correct. The proof may be a letter from you, or it may be a listing of your name in a directory, or it may be a salesman's report after calling upon you.

The auditor's most recent check of our circulation, summarized your name and others on our lists in this manner:

Classifications	Canada	Foreign	Total
Manufacturers of Electronic Equipment and Components, Radio, Television and Communications Equipment	2,159	11	2,170
Telephone and Telegraph Companies	1,196	1	1,197
Public and Privately owned Utilities	908	—	908
Radio and Television Stations, Recording Studios	510	—	510
Government (N.R.C., D.R.B., A.E. of C., D. of T., Armed Services)	585	3	588
Airline, R.R., Communications, Police, Fire, etc.	207	—	207
Universities and Private Research Laboratories	220	—	220
Industries using Electronic Equipment in Manufacturing and Processing	750	—	750
Hospitals	370	—	370
Distributors of Electronic Equipment	188	—	188
Engineering Firms and Individual Engineers	518	1	519
Manufacturers Incorporating Electronic Equipment in their Finished Product—Aircraft etc.	499	—	499
Miscellaneous and awaiting classification	30	3	33
TOTAL	8,140	19	8,159
Average for the Period			8,402

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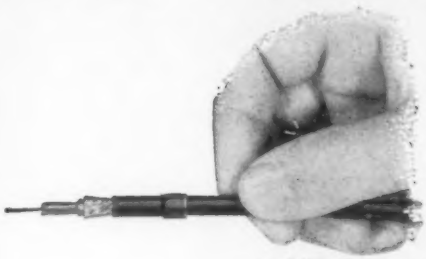
CCAB CANADIAN CIRCULATIONS AUDIT BOARD INC.

coaxial and shielded cable grounding

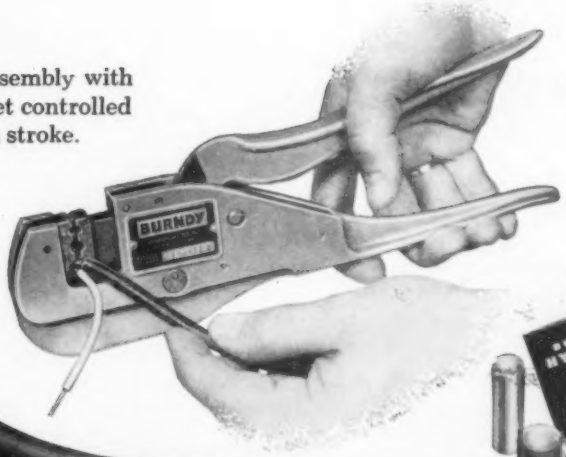
completed in 90 seconds with HYRINGS

STRIP shield. Slip outer Hyring over insulated conductor. Slide inner Hyring under shield.



INSERT ground lead under outer Hyring and line up over the inner Hyring.

INDENT, assembly with single ratchet controlled compression stroke.



COMPLETED assembly, with Burndy Hylug attached to free end of ground lead.

For details on color-coded BURNDY Hyrings, write for Hyring bulletin.

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Thoroughly effective communications with maximum economy is the keynote of Pye VHF and UHF radio communication equipment. Years of intensive research have produced two-way radio that will out-perform competitive makes — yet costs less. Simplified circuits and heavy-duty components provide unfailing service and lower maintenance costs. Mobile units and base stations are available in a number of styles and ratings to suit all requirements. In addition to the AM line Pye now has FM Equipment, fully compatible with existing systems.

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Whenever you wish to instruct people vocally, from a distance — use the Pye Transhailer.

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Pye HF radio equipment gives wide coverage over rugged terrain and is engineered for heavy duty with minimum maintenance. It is suitable for use in permanent or temporary locations on land and water.

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MODEL PCL-20 — Rated at 20-watts r.f. output, the PCL-20 gives you top performance and economical operation where high power is not required. Five crystal-controlled channels in the 1.6 to 4.5 mc. bands, plus standard broadcast (540-1700 kc.).

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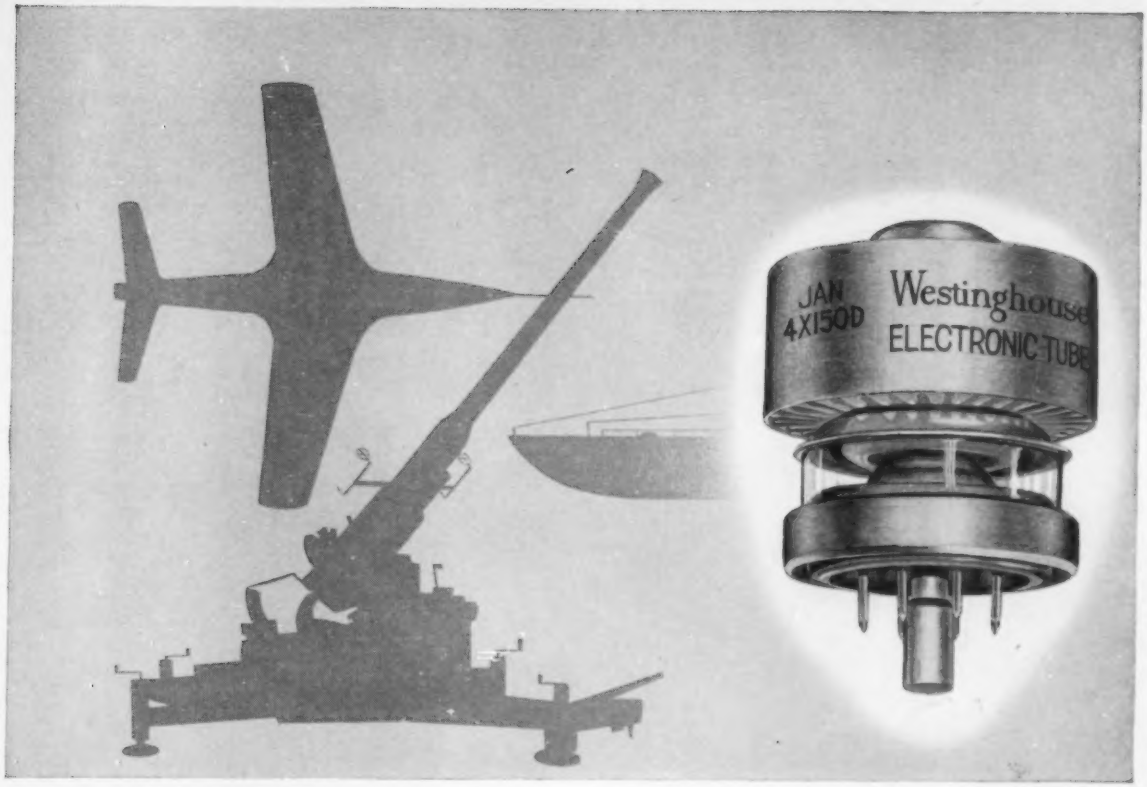

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Does the industry know where it's going?

Canadian Electronics Engineering is pleased to present in this issue its first annual Industry Review and Forecast. For this special report CEE's staff did a tremendous amount of research and talked and wrote to hundreds of men across Canada.

When the mass of data had been digested it appeared—and this comes out in the pages of the Review and Forecast—that the industry has a hard core of people, in both large and small companies, who are meeting their problems with intelligence and initiative. On the other hand, there are others who are still suffering a hangover from the boom years of 1948-1955 and who refuse to accept the change of pace as a challenge.

Statistically, the industry has never caught up with itself. The Dominion Bureau of Statistics is now making a valiant attempt to sort out electronics from heavy electrical equipment. Defense contract figures, nominally for electronic equipment, include major payments for air freight and other services. Out of a total turnover of $500,000,000—a figure which itself is hard to check—DDP accounted for $124,000,000 in 1956 of which a considerable portion was for services, particularly in connection with the Mid-Canada Line. So that, instead of being responsible for 25% of the industry's activity, defense may only have been about 15%.

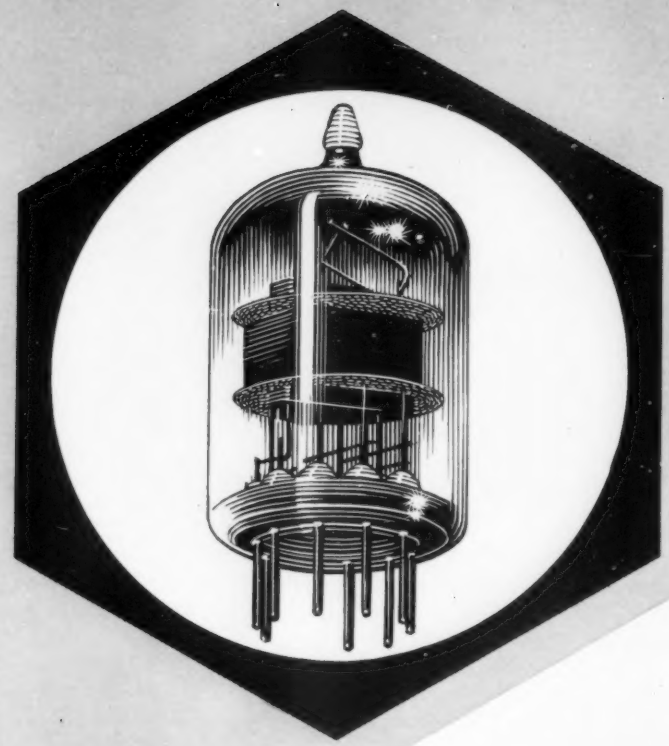
In industry, TV and radio receivers and record players are well documented because they are consumer products and an easy check can be kept. But the picture is confused when it comes to industrial electronics and communications equipment—a field in which there is tremendous room for expansion. The recent decision of RETMA's Electronics Division to commence detailed documentation in 1958 is therefore very welcome.

What are the trends? The Government does everything possible to place contracts with the Canadian industry; but there are occasions on which national security or other considerations take precedence. The feeling in Ottawa is that although there may be a lull in defense electronic procurement at the moment, for obvious reasons, the end of this year will see a healthy rise.

Many executives are realizing that consumer production to catch the fast dollar is not necessarily sound economics for a company which wants a future in the industry. Canada has as much chance in one field of electronics as any of the larger and more powerful countries in the world—the field of research and development. Brains count; they count much more in a young industry which by the end of the century could change man's conception of the universe.

It is exciting to be in an industry where such a challenge exists; it is invigorating to know that it can be met. The Canadian electronics industry has a great future—it can, we know, match up to it.

THE EDITOR



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Special report

INDUSTRY REVIEW & FORECAST

1957-58

1957 A year on the plateau

Electronics in Canada

The industry's actual and estimated dollar value of sales for 1956

Television Receivers	$184,000,000
Radio Receivers	55,000,000
Record Players	13,000,000
Defense	124,000,000
Broadcast General Communications Sound Equipment	27,000,000
Replacement Parts, Components, Tubes, and Services	100,000,000
TOTAL	$503,000,000

Source: RETMA

- **High — and the low — spots**
- **Problems of TV makers**
- **Who came off best?**
- **No doubts — defense down**

1957 ROUND-UP: The Canadian electronics industry stayed on the plateau. Final figures are not yet available but indications are that over-all sales were similar to those of the two previous years, at about $500,000,000. Experts agree that the $503,000,000 of 1956 has not been reached but the reaction, with a shrug of the shoulders, now is: Any industry turning over half a billion—and with our future—is worth being in.

It was a year when manufacturers kept their fingers crossed—but TV sales continued to go down while industrial electronics showed possibilities for advance.

THE TV DROOP: During the last few years TV manufacturers have been jumping in and out of the business like fast-moving shuttlecocks. The solid phrase "home entertainment" still represents the major segment of the industry with TV taking 73% of it. But TV receiver sales sagged to about 475,000 units in 1957—23% less than in 1956. Peak year was 1955 with 776,000 units.

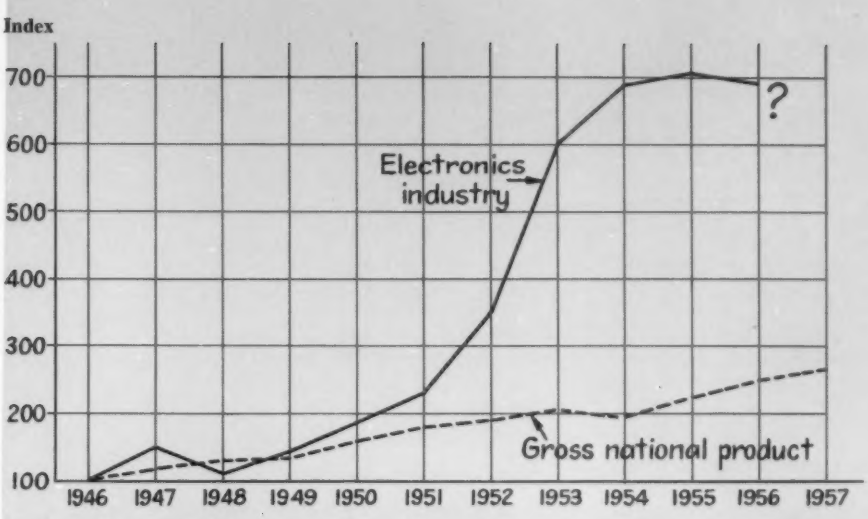
THE SOUND BARRIER: Radio and hi-fi makers watched cheerfully while their sales figures continued to go through the sound barrier. Radio receiver sales were around 700,000 units while consumer purchases of record players and records left everyone gasping. But in the popular, as distinct from the connoisseur, hi-fi field, it was a cut-throat business. One manufacturer reported that it was a question of a couple of dollars on a particular player between sales failure and success.

DEFENSE DEBATE: The great debate, on whether defense spending is down has been won, in this Review at least, by the majority of manufacturers reporting a drop—not a body-blow, just a noticeable drop. Government defense contracts, for electronics and communications, equipment, including services, rose from $89,545,000 in 1953 to $124,235,000 in 1956. Change of government, uncertainty about the ratio of manned planes to missiles or other new gadgets has obviously held back plans and expenditure and this figure will be down in 1957.

OVER-THE-TOP: Biggest advances have undoubtedly been made in the telecommunications and industrial electronics fields. Canadian firms developed shf scatter and Janet, the meteor trail communications system. Both have attracted wide interest in North America and Europe. Firms have been moving into the computer field and on the manufacturing side alone IBM Canadian factory exported about $11 million worth of equipment, with $5 million going to the U. S.

STILL THEY COME: But the fortunes of the industry in 1957 have not caused it to stultify. As one executive put it: " . . . the opportunities in electronics are so diversified and so spectacular that they are attracting many companies which were not formerly regarded as competitors. The recent patterns of the industry, its markets, its supply and distribution patterns, its competitive patterns, are changing rapidly—as is natural in an industry so alive with opportunity."

1958 What really lies ahead?



How the industry has grown

Growth of electronics industry in relation to gross national product Index—1946 = 100

Source: RETMA

1958 OUTLOOK: The general economic forecast for Canada varies between a continuing slight recession and a leveling off, with a slight seasonal mid-year rise. The Canadian electronics industry hopes, privately, to do better than this but publicly no one will say so. The feeling is that if the turnover can be held at around the $500,000,000 mark there will be a sigh of relief at the end of the year and considerably more optimism for 1959.

BREAK-THROUGH: Biggest advances are likely to be made in the computer and industrial electronics fields. Computers are now being designed to help smaller businesses operate more efficiently. The application of electronics to office machines and procedures could expand astronomically. Potentialities of industrial TV are hardly realized. Communications networks are relying almost exclusively on microwave equipment. Another 7,000 transmitting stations will be licensed in 1958, with markets for suppliers of both mobile and fixed equipment. Here is the big expansion.

NOISY NEWCOMER: South of the border missiles are news. Electronically, in Canada, little has been done. But the Government has to keep up with defense weapons and industry leaders forecast an expansion in missiles systems research; one major firm was steadily building up its missiles group in the last few months of 1957. Missiles should offer new fields in 1958 with a noticeably larger dollar expenditure in the years to follow.

BACKROOM BOYS: Electronics firms are putting a higher proportion of money into research. RCA Victor's laboratory in Montreal is doing a considerable amount of pure research. More companies have indicated they are prepared to invest in ideas as well as items. Sub-contract policy by both government and bigger firms will be aimed to encourage this to a greater extent.

MARKING TIME: Downward trend in home entertainment may be stopped. Percentage of possible replacement TV sets is rising steadily and with the installation of more satellite stations an increased number of viewers come onto the market. Opinions have been expressed privately, but forcibly, that the CBC TV monopoly should be relaxed in the denser populated areas. At the same time there is possibility of Pay-TV. Either of these, say manufacturers, could stimulate interest in TV in 1958 and result in a major upswing in set buying. Color is not seen as a Canadian gimmick until about 1960; then, as in the U. S., it might not produce substantial set sales. Meanwhile radio and hi-fi should keep their upward trend with stereophonic sound a lusty newcomer.

THE CRYSTAL BALL: 1958 should be a continuance of the "breathing space" making a total period of some three years. After that, it's anybody's guess, although generally an optimistic one. The Royal Commission survey estimated electronics sales of $800 million by 1965. That figure could be made to look small.

Industry's future lies in research work

In this special statement to Canadian Electronics Engineering W. H. Jeffery, P.Eng., reviews the industry and suggests that in 1958 the big role is in research and development. Mr. Jeffery is president, Radio-Electronics-Television Manufacturers Association of Canada (RETMA) and vice-president and general manager, Philco Corporation of Canada Ltd., Toronto.

As far as consumer products are concerned the industry in 1957 has gone through a period of adjusting itself to lower levels of products and sales. As a result there has been some mortality amongst the manufacturers, distributors and dealers, but the outcome for the individuals who are still in the business at this time is that each one has become stronger as a result of this "trial by fire."

Thus they are all in a better position to cope with the problems ahead due to the economies and reorganizations which they have been forced to implement.

New interest in radio

The outstanding results in the consumer products line of the electronics industry in 1957 have been such things as the trend towards slimmer television receivers, the resurgence of interest in radio of all types and the greatly renewed interest in the playing of records has resulted in the hi-fi craze.

The latter is largely due to the new techniques both in electronic recording which puts on the records or the tape much more of the original sound and in the reproduction of the sound in the home by new types of equipment such as electrostatic loud-speakers. Part of the resurgence in interest in radio can be traced to the greater use of transistors and here is a tremendous field which has just opened up for us.

Government business in 1957 has been down drastically from previous years due to cancellation of some contracts and the stretch-out of others. This has forced most companies who leaned heavily on government business to reconsider their entire activity and to expand their activities into the industrial electronic field.

This has opened the doors for many new activities in Canada, so that products which formerly were only thought of as possibilities are now definitely in the mill for Canadian production. Such things as industrial television have a tremendous future, only a few of the possible uses for it having so far been thought of and put into practice.

Low defence volume

In defence work I feel that we have reached what might be considered a low in our volume and that we can only go upwards from here. The big factor which remains to be decided is the way Canada should go. I think we have proved beyond doubt by our participation in such extremely complex problems as the Pine-Tree Line, Mid-Canada Line and many defence devices such as complicated airborne radar and search mechanisms, that we can both design and produce anything that any nation in the world can do. Here, I believe is the biggest field of all.

Canada being an industrially small country is weakened because of its smallness, particularly in mass production efforts. The penalties of smallness, however, are not nearly so great—in fact they are almost non-existent—when it comes to research and development. This type of work can be and must be done in small compartments and we can therefore perform satisfactorily and with just as much excellence as any other country, regardless of size.

I believe the government is beginning to realize this. Not only can we make a present contribution in this way, but if we do our future is assured. As we all know in industry, the ones who hold the basic knowledge, whether it is covered by patents or not, are the ones who are usually called up to produce the products which are based on that knowledge.

This is the industry's big role in 1958—the development of Canada from a research and development standpoint with the long range field in mind. Ultimately that will convert itself into the production work which we all need so much.

Facts on the electronics industry from the men at the top

Canadian Electronics Engineering asked electronics firms across the country to contribute to this special INDUSTRY REVIEW AND FORECAST. Covering 1957 and reviewing 1958 executives and leaders in all branches of the industry were asked to give details of their company's activities in the following areas:

Expansion of production facilities, either by extension of existing facilities or the opening of new plants.

Extension of existing product lines or the addition of new lines.

Important contracts received or completed.

Significant development programs initiated or completed.

Generally, their replies add up to this brief summary of the present position of the industry: Buoyant, optimistic that the next 12 months will see the curve beginning to go up.

Fall-off in military electronics

In 1957 the **Acme Electric Corporation Ltd.,** Toronto, experienced a fall-off in business in electronics products for the military program and also for radio and TV. But development of other lines such as antenna couplers, attended and unattended battery chargers, thyratron type dc motor controls, epoxy encapsulated units etc., helped compensate for loss of other business.

The antenna couplers produced are used to screen high-frequency or electronic discrepancies between transmitter and antennas. These operate between 2-10 mcs and withstand a 10,000 v/rms dielectric breakdown test.

Acme enters 1958 with confidence and has already received an order for transformers for delivery in the first quarter of 1958 for military installations.

Videotape recorder in Canada

Sales during 1957 of the **Canadian Division of Ampex** have been consistently above 1956 and at the end of November they were running at 170%. The company expects major sales from the new Videotape recorders, production models of which are now being received by TV stations. Present machines handle black and white but color conversion can be accomplished by adding another rack of electronics when the time comes. Price of a recorder in Canada is $54,000 but savings can run at hundreds of dollars a day.

In 1958 the Ampex automatic programming equipment, which offers a building block approach, will be available. Another new trend is the use of multi-channel recorders in studios, three or more tracks being recorded separately and the mixing done after studio hours.

Optimism for 1958

Because of orders on hand and expected **Andrew Antenna Corporation Ltd.** have increased the floor space at their Whitby, Ontario plant by approximately 35%.

Their activities in Canada are expanding with the result that they now manufacture a high percentage of all the items sold when the company started in 1955. At that time they acted primarily as a warehouse and sales organization for their American affiliate, the Andrew Corporation of Chicago. This has meant a big increase in the manufacture of components at Whitby.

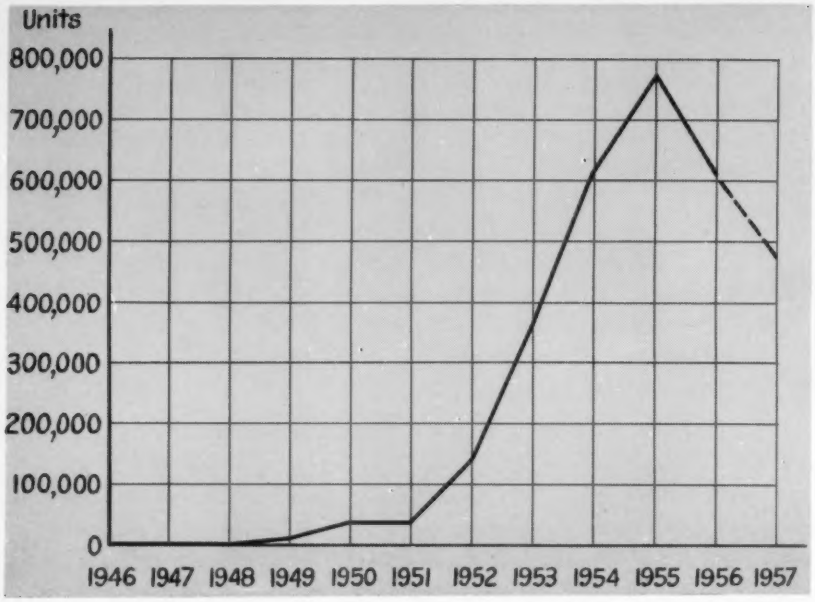
Research facilities expanded

Although a great deal of research work has been carried out at Chalk River during 1957, probably the most important single achievement was the completion of NRU reactor. With this and the other facilities, **Atomic Energy of Canada Ltd.,** has maintained its position as one of the world leaders in nucleonics research. Additional facilities are under construction, notably the 10-million-volt Tandem Accelerator scheduled to go into operation in the early summer of '58.

Applied research has also continued with the existing facilities such as NRX. This has, as well, been the basis of the commercial operations of the company. During 1957 they made approximately 871 shipments of isotopes amounting to 98,000 curies of activity. This was an increase of nearly 100% over the previous year.

Construction of the 20,000 kw electric power reactor NPD was suspended until new design information could be incorporated.

(continued on page 26)



TV sales 1946-57

Canadian sales of television receivers 1946-57. Unit sales in peak year, 1955, were 776,536. 1957 sales expected to be around 475,000 units.
Source: RETMA

Consumer products —

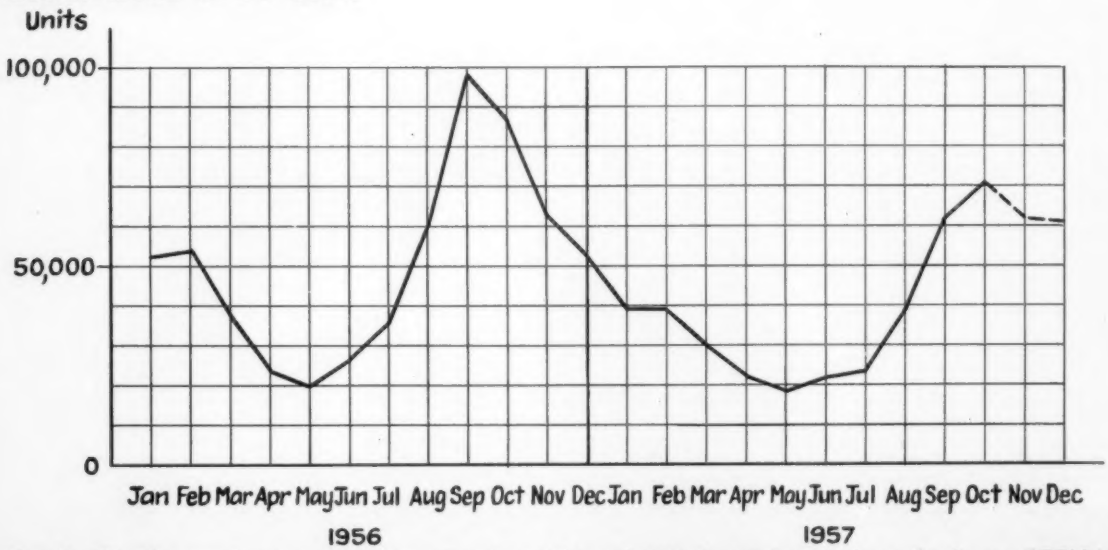
The industry's problem child

Domestic radio and television receivers and record players are currently the largest product group within the Canadian electronics industry. In 1956, the last year for which complete figures are available, combined sales of these products were estimated at $252,000,000—almost exactly half the industry total of $503,000,000. Although sales in 1957 were lower, largely due to a continuation of the fall-off in television receiver sales from the peak year of 1955, this segment of the industry was still the largest. Outlook for 1958? Somewhat brighter.

Television receivers

As can be seen from the chart above, production and sale of television receivers was started in Canada in 1949. However, sales were small and confined to areas within the range of U. S. border city stations.

Recent trend in TV sales



Monthly TV sales over last two years show seasonal variation and stiffening trend of last 3 months. Source: RETMA

The first Canadian stations came on the air in 1952 and from that year until 1955 TV sales rose at a phenomenal rate. The rate of growth was almost twice that experienced in the U. S. in a comparable period: 65% of wired homes were equipped with television during a period of four years—in the U. S. this took seven years. 72% of wired homes within effective program range now have TV.

W. H. Jeffery, President of RETMA of Canada, recently gave the very rapid market penetration as one of the reasons for the 39% drop in TV sales in 1957 from 1955 (23% from 1956). Addressing the Components Division of RETMA, Mr. Jeffery also suggested the following additional reasons:

Delay in start of Canadian telecasting has resulted in there being no significant replacement market to date.

Heavy population areas were opened up first with TV stations, thus condensing the demand.

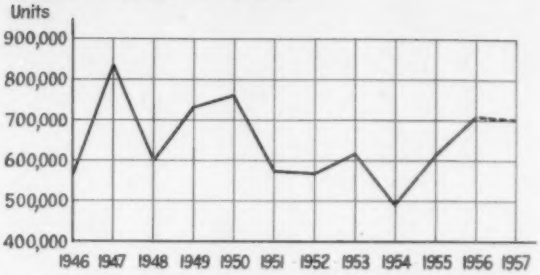
Policy of not licensing more than one VHF station in major areas has contributed to slower penetration in many good potential markets.

Quoting the results of a survey which showed that 45% of the sets in the larger Canadian cities are over three years old—with a higher percentage in the border cities—he forecast that replacement business would start in 1958. This, together with the new normal TV business in the many homes still without their first TV set, he said, would form the immediate market in 1958 and 1959, suggesting that from the "plateau" of 1957-58 the industry would go into the "foothills" in 1959.

Stuart D. Brownlee, executive vice-president of Canadian Admiral, points out:

There are now just 13 manufacturers of TV sets in Canada as compared to a one time high of about 25. It is estimated that nearly 60% of the unit sales are made by the top five companies. In 1958 television dealers will find the going tougher as high-volume-low-markup selling gives way to a more sensible trade-in approach to the customer.

Radio receiver sales



Sales of radio receivers in Canada, including combinations, portables and automobile sets. Year-to-year variation is quite marked. 1957 sales show healthy comparison with peak years of 1947, 1950. *Source: DBS*

Radio

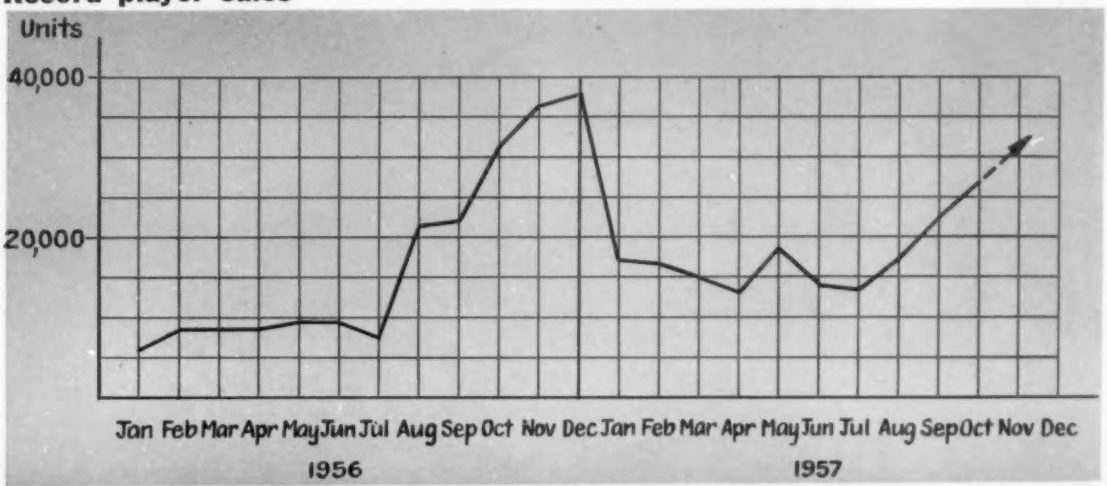
Sales of radio receivers in 1956 totaled 710,000 units. Final 1957 figures are expected to bring the year's total to around 700,000. These figures represent a volume of business which has not been reached since 1950 and which compares favorably with the record year of 1947, when sales of all types of radio sets exceeded 836,000 units.

Outlook for 1958 is good, with a considerable proportion of the total production going into automobiles. Interest in FM radio continues to grow among those people who have a preference for good music, and though not greatly significant as yet, FM sets should form an increasing percentage of radio sales.

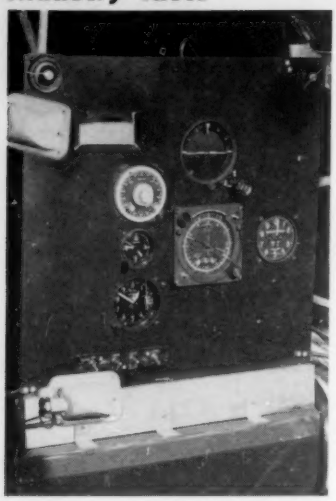
High fidelity

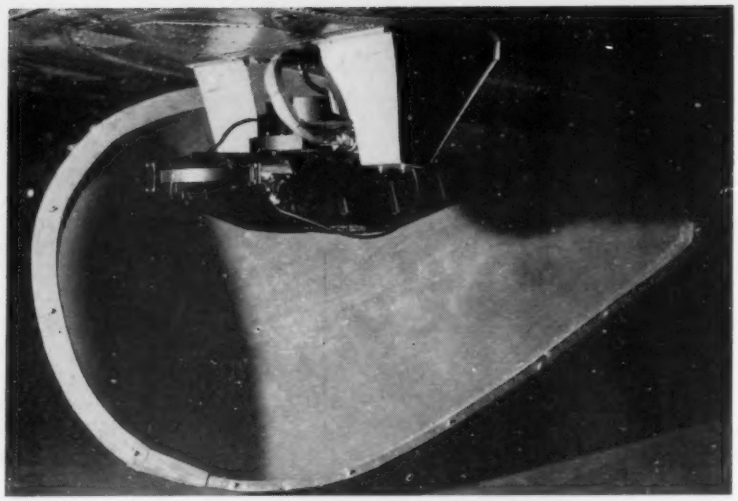
The sale of record players, phonographs and radio-phonograph combinations are really on the climb, and there is plenty of room for growth. The chart shows sales over the last two years and clearly demonstrates the extent of the rise: average monthly sales during the "quiet period" in the first half of the year were about double the level in 1956.

Record player sales



Canadian record player sales with and without amplifiers. Note increase in first half of 1957. *Source: DBS*





Canadian-built Doppler radar navigational system. Left instruments, right antenna

Canadian laboratory oscilloscope

During 1958 there will be additional plant expansion for **Bach-Simpson,** particularly in space allocated to engineering and tool and die manufacture. Expansion will be directed to providing completely independent service in both product design and application engineering in the instrument field.

The company has available the first completely Canadian designed and manufactured high quality laboratory oscilloscope. Another development which will be completed in 1958 is the new wide-band vacuum tube voltmeter of laboratory quality.

To supplement their panel instrument line there will be a comprehensive catalogue of current and voltage transformers based on Canadian design and manufacture. There will also be a complete line of frequency meters.

Extensive telephone construction

Development of the **Bell Telephone Company** services in 1957 was marked by the addition of some 190,000 new telephones, raising the total in service to 2,960,000. Over $175,000,000 was spent on new construction. There was further rise in the volume of long distance calling, the number handled showing an increase of almost 8% over the previous year.

In Toronto direct long distance dialing will commence in May, 1958, through switching equipment of the crossbar type while customers' bills will be prepared through automatic message accounting machines.

By December of 1957 the microwave network of the Trans-Canada telephone system stretched from Quebec City west to Calgary and Edmonton. The full network from Sydney, Nova Scotia, to Victoria will come into service in the summer of 1958.

The tropospheric scatter system is to be used on part of a radio-link now being constructed in cooperation with Quebec-Telephone to connect Quebec City with Goose Bay, Labrador.

Year of great progress

In 1957, a year of "great progress for **Canadian Admiral,"** the company increased its share of the TV market, improved quality, appearance and design and achieved a better ratio of profit to sales.

The company completed a long-term program to establish factory-to-dealer distribution from coast to coast and opened its largest factory sales branch in Winnipeg. Improvements in production facilities included the setting up of lines to manufacture vhf and uhf tuners in Canada.

Sales of radio sets more than kept pace with increased purchases. Future prospects for radio sales are rated excellent because of lowering cost, durability, lightweight and lower power drain of transistors. High-fiidelity is also making tremendous gains in Canada and the company expects to see great progress in the future use of fm broadcasters.

Admiral's new electronics division has made progress with two new products — a dot generator and a radarscope speed meter.

More room for C.A.R.

When PSC Applied Research became a member company of the A. V. Roe Group early last year its name changed to **Canadian Applied Research Ltd.** Since then its plant in Toronto has been expanded and production facilities now cover 56,000 square feet over three buildings. Facilities including machine shop, plastic shop, sheetmetal shop and gear cutting shop can now be offered for precision engineering.

There is also an environmental test laboratory completely equipped to carry out qualifications of instrumentation equipment.

During 1957 two of their products received prominence. The auroral recorder used to make permanent records of the intensity and duration of the Northern Lights, was one. The other was the airborne profile recorder, an improved precision radar altimeter.

Hamilton Company

Formed in 1957 **Canadian Electronics Company,** Hamilton, Ontario, produces stabilized power supplies, transformers, coils and television deflection yokes.

The company also has additional capacity available for the production of a variety of electronic equipment.

Specialized receiving tubes

Because of the rapidly growing market for high reliability receiving tubes, virtually nonexistent in Canada three years ago, the tube section of **Canadian General Electric** is now manufacturing these tubes for industrial and military applications.

The facility is being fashioned after "Operation Snow White" with which the General Electric Company pioneered the production of 5-star tubes in the U. S. Production in Canada has started on the first type, 5654/6AK5W and will be expanded. The full facility is planned to be in operation by the fall of 1958.

Early in 1958 the tube section will also begin to manufacture low-current rectifier cells from both germanium and silicon crystals.

Defense spending drops

A considerable drop in defense spending has affected the electronics division of **Canadian Westinghouse,** although it is hoped there will be an improvement in this area in 1958.

Electronics division development programs have produced several new products in 1957. These range from simple low-cost photo-electric relays to complicated Nultrax systems for machine control. Linatrol, the new tracing device for gas cutting, is now distributed nationally to consumers.

Shf scatter equipment, a Canadian Westinghouse "first," has been successfully operating on a 24-hour basis over the Hamilton-Kinmount test link and reliability equal to, or better than, toll standards is being experienced.

There is no evidence that 1958 will show any marked improvement although anticipated government defence spending may cause a slight rise in the last quarter of the year. It would appear that 1957 was a leveling off year for equipment manufacturers and this level is likely to continue for several years.

See sales up 10% in '58

1958 looks like a good year, said F. Hancock of **Cannon Electric (Canada) Ltd.** He expected that sales of their products and services would be up about 10% over the 1957 figure. A large part of this would be for connectors used by the aircraft industry for both power and electronic circuits.

During 1957 the company expanded their facilities for fabricating wiring harness to customer specifications. One section of the plant is now devoted exclusively to this operation.

Design new style relay

A new approach to the design of relay armatures was used by **Carriere & MacFeeters Ltd.** to overcome vibration and shock problems. They used a balanced armature system to meet the severe operating conditions on one military contract. Another new product in 1957 was a high temperature solenoid that had to work in an ambient temperature ranging from —55F to +400F.

Prior to this, Carriere & MacFeeters were engaged primarily in repair and overhaul work. However, they

Electronics industry 5 year stock prices

	1957*		1956		1955		1954		1953	
	High $	Low $	High $	Low $	High $	Low $	High $	Low $	High $	Low $
Admiral Corp.	..	..	18	17½	26½	26½	20	20	32	25⅛
Analogue	3.50	1.95	..	..	..	..	..	..	..	..
Anglo Cdn. Tel.	46	36	50¼	40	53	47	48	39	42	37
Beatty Bros.	7½	3½	8	6	8¾	6¾	7¾	6⅜	8	6
Bell Tel.	46½	35⅝	51¾	43¾	52¼	45⅛	47	39¾	40	35⅛
B.C. Tel.	47¼	37	52¼	43	50½	43½	45	35	36⅜	32½
Cdn. Gen. Elec.	765	700	1000	755	1100	675	675	545	625	410
Cdn. Marconi	4.10	1.90	6.62½	3.00	8⅜	6	7¾	4¼	5½	2¼
Cdn. Westinghouse	50	35	52	35⅛	70	47½	78½	62	72	55
De Havilland A	190	190	150	150	200	141	160	98	120	75
Dom. Electrohome	13	8	15	7	7¾	3¼	5¼	3½	7½	4¼
Fleet Mfg.	1.10	.30	2.00	.85	2.85	1.40	2.55	1.55	2.25	.75
Gen. Dynamics	66½	47	77½	45¾	125⅛	48	80	35	45⅛	31
Inglis, John	6.50	2.50	17	4¼	14	10¾	12½	7	12½	9¾
Isotope Prod.	1.85	1.10	2.60	1.15	..	..	..	..	..	..
Northern Tel.	4.50	2.90	..	..	..	..	..	..	..	..
Quebec Tel. (new)	25⅜	16½	21¾	18½	25	14¾	..	..	..	..
Do A (new)	..	..	183	180	..	..	..	..	..	..
Do (old)	..	..	..	..	52¼	39	40	12	12	6¾
Do A (old)	..	..	..	..	..	..	96	36	34	19
Roe, A. V. (Can.)	25½	10¼	18⅛	16	..	..	..	..	..	..
Stand Radio	12	12	12¼	11	12	9	11⅞	7	7¼	5½

*Compiled at week ending December 6, 1957

now have manufacturing space of 22,000 square feet with provision for an increase to 40,000. All engineering design is done by their own staff which is one of the reasons they can economically undertake to design and manufacture the small quantity runs of specialty relays and solenoids. During 1957 their staff increased almost to 100.

Start producing switches at Ajax

Centralab Canada Ltd. completed tooling in late '57 for the production of some types of switches at their plant in Ajax, Ontario. By the end of 1958 this will be expanded to include all the popular types of Centralab switches.

Prior to this the company was manufacturing ceramic capacitors, resistors and printed electronic circuits in Canada. Most of these went to the receiver industry. The switches, however, are expected to be used also in military and industrial applications.

Newcomer in the field

C. P. Clare (Canada) Ltd. was incorporated in October of 1957 with joint ownership by Fischer & Porter (Canada) Ltd. and C. P. Clare (Chicago). The company manufactures a complete line of custom made relays, stepping switches and lever keys for the electronics industry. Assembly of these items will be made in Canada at the company's plant in Toronto. Present production space is 1,500 sq ft, expandable to 2,500 sq ft.

The company has recently begun production and marketing of a new micro miniature relay. Selling is meeting expectations.

Big Government contracts

Collins Radio Company of Canada Ltd. production facilities have not expanded in 1957, and still consist of 50,000 sq. ft. of space with 250 people employed.

Production lines during 1957 have been mainly occupied in the production of High Frequency Airborne Transceivers — Trans Horizon Scatter equipment — General point-to-point communications Transmitters and Receivers, and Amateur Receivers.

Two important government contracts were received during 1957; one for the ARC-38 HF Airborne Transceiver and the other for the ARC-552 UHF Airborne Transceiver. Development programs related to the general company activity in airborne equipment have been initiated.

CDC turnover $5,000,000

Total dollar value of products sold by **Computing Devices of Canada Ltd.** including development work and computing services, was approximately $5,000,000 during 1957.

In that year this Ottawa firm opened a new 75,000 square foot building at Bells Corners for the manufacture of components for the aircraft navigation systems produced by the company and for assembly of specialized electronic equipment. The latter includes the only facilities in Canada for the manufacture of magnetic core arrays.

During the past year CDC activities in expansion of Bendix-Decca facilities continued with the opening of four chains of ground stations giving coverage of eastern Canada from east of Newfoundland to Montreal.

Most significant of new contracts was that received for development of a navigation and intercept system for the CF-105. This will be one of the most advanced automatic dead reckoning systems in the world.

Development work continued during the year on the ANTAC system for the new RCAF Maritime reconnaissance aircraft, the Argus. In the commercial field, CDC completed a first prototype of the Type W 410 Kicksorter, a transistorized 100 channel pulse height analyzer.

Curtailment in defense

As far as 1957 is concerned **Continental-Diamond Fibre of Canada Ltd.** has seen a noticeable curtailment in some defense projects as well as in the television industry. In other areas business has been satisfactory although somewhat less than the previous year.

In 1958 major expansion will be in the area of testing and measuring equipment. Several months ago the company acquired the Non-Destructive Testing Corporation (Canada) Ltd. as the first step in a policy of diversification. Plans include the construction of a showroom and laboratory to exhibit and demonstrate modern equipment for non-destructive testing, physical testing and isotope radiography.

Production of Weston instruments

Early this year **Daystrom Ltd.** of Toronto will embark on a production program covering Weston instruments. The Canadian company began operations on April 1, 1957. Then they were employing six but by the end of the year this had risen to more than 30.

The company handles Heathkits which have been expanded during the year by such items as a transistor radio direction finder kit, transistor portable radio, electrolysis detector and a 70-watt amplifier.

Large scale computor system

Most significant new addition to the **ElectroData** line is the new large scale Datatron 220 electronic data processing and computor system. This provides giant computing facilities at lower costs, a basic system renting for approximately $8,000 monthly or selling for $355,000. Deliveries of the system can be made in six to seven months.

Manufacturing associate

Because of the increasing amount of work **Electrodesign** of Montreal, Quebec had to split their combined sales and manufacturing organization. They have established Vector Labs as a manufacturing associate.

Both manufacturing and sales, where new lines are always being added, are continually expanding.

Company exports ideas

Mr. E. Leaver stated that **Electronic Associates Ltd.** did a lot of development work during 1957. Some of the radiation equipment and process control equipment has attracted the interest of manufacturers outside Canada and they have signed manufacturing agreements. There are more agreements under negotiation at the present time which indicates that the export of ideas will increase in 1958.

Emphasis during 1957 has been toward commercial work, both for the manufacturing division of the company and for the technical publications division. The latter has undertaken a number of commercial projects to achieve a better balance between the military and commercial markets.

New plant in '57 . . . expanding in '58

A new plant with 17,000 square feet was opened in February 1957 by **Electronic Components Ltd.** Since that time, business has increased sufficiently to justify making preliminary plans for an extension to the plant.

This Canadian owned company was formed in September of 1956 to manufacture glass cartridge fuses in the range of 1/100 amp. to 60 amps. It is the only company manufacturing this type of fuse in Canada and they intend to increase the range of fuses manufactured during 1958. Preliminary investigations are also under way before expanding their product lines to complement their fuse production.

Company changes hands

Electronic Controls Ltd., was purchased in November 1957 by A. D. Revill. At the present time they are concentrating on engineering and sales facilities in the heavy industrial electronics equipment. However, they plan to move into the light electronics field and are currently viewing the market to determine the actual product lines.

Mr. Revill, a graduate in Engineering Physics from the University of Toronto, gained experience in communications equipment, radar and control equipment while working at Northern Electric.

Doubled production area

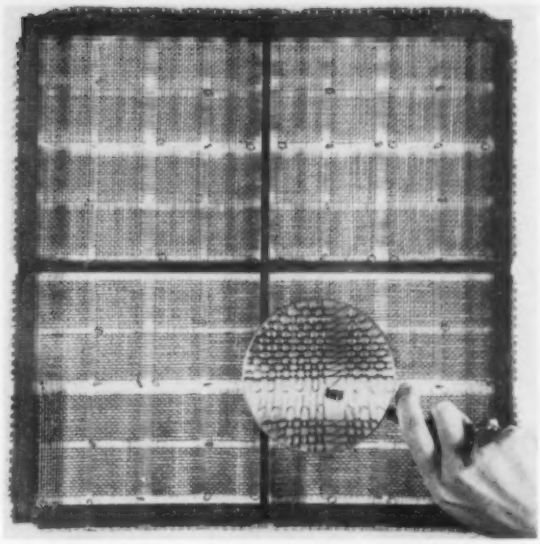
Doubling of production facilities was completed in 1957 by **Fischer & Porter (Canada) Ltd.** This was necesary because of increased sales activity in all product areas, particularly data handling equipment, panel fabrication and water and waste treatment equipment.

Among important contracts were automatic loggers for Union Carbide in Scotland and B. C. Power Commission in British Columbia. For the year end April 30, 1957, total products sold amounted to approximately $1,400,000. Current rate of selling is at the same level.

New and bigger premises

New and modern premises have been occupied by **Electro-Vox Inc.** of Montreal, increasing the production area by more than 50%. An additional 50% is reserved for future expansion.

An affiliated U. S. company is handling their sales,



CDC's kicksorter memory. It has 16,384 cores

service and installation of intercommunication and sound systems in the U. S. New lines have been developed particularly in the field of hospital signalling and intercom systems and large hospitals equipped include Deer Lodge, Winnipeg, and Hospital du Sacre-Coeur, Hull.

The company has also added advanced automatic telephone equipment to its product lines and systems are available from the simplest common talking type to automatic exchanges for 10-100 subscribers and larger. Electro-Vox expects to keep expanding its range.

Share of the market goes up

Although television set making companies experienced a reduction in volume of around 35% during 1957, **General Instrument-F. W. Sickles of Canada Ltd.** were able to raise their dollar volume of business slightly above that of 1956 by obtaining a substantially larger share of the market.

The company manufactures television tuners, deflection yokes, horizontal output transformers and i-f transformers together with a wide range of small coils. During 1957 the company developed a new high gain tuner and in 1958 it will offer the Model 100 tuner.

A new division, Canadian Radio Receptor, has been formed and will produce and distribute in Canada the designs for a wide range of professional equipment including transponder beacons, target beacons, ground support equipment, decoders and radio transmitters and receivers.

Changeover of models

A complete changeover of all models was carried out by the **Hallicrafters Canada Ltd.** in 1957. Transistor radios were introduced at the beginning of the year, including the unique Porta-Console radio, designed for home use as well as an outdoor portable. High fidelity consoles were re-introduced at a lower price range and proved extremely successful.

Notwithstanding a substantial decline in industry sales in Canada in 1957 the company's sales volume increased both in number of units and dollar volume and inventories have been maintained throughout the year at a realistic level.

Busy year, move to new plant

It has been a very busy year for **Hammond Manufacturing Company Ltd.,** of Guelph, Ont. Production of transformers has continued at capacity and they have moved their plant into a new building covering 90,000 square feet with increased facilities for laboratory research and testing. Previously there were two factories in the same town.

Hammond, an all-Canadian company who have been manufacturing transformers for 30 years, carry 1,000 different items as stock units.

Expanding product lines

Considerable expansion of product line by **Helipot Corporation** took place in their Toronto factory. Production was commenced on the series 5,000 half-inch diameter single turn precision pots and the series 5,400, 5,600 and 5,700 single turn pots.

The company developed successfully a high temperature rectilinear potentiometer for a large aircraft company. The unit had to meet a temperature of 125°C as well as stiff environmental specs on vibration, shock, endurance cycling, etc. The unit is only .625 inches in diameter and is now in production. Considerable expansion in production of rectilinear pots is expected in 1958.

Present plans are such that the company expects to grow considerably in the next two years and move into a larger plant during that time.

Opening of large plant

With the opening in 1957 of their new plant in Scarborough, Ont., **Honeywell Controls Ltd.** expanded its existing facilities. The plant, which cost $1,000,000, combines all of the Canadian division's production facilities under one roof.

The company manufactures over 50 basic types of controls for heating, commercial and industrial applications, plus special equipment for military aircraft. Future plans call for the manufacture of even more devices, including a total of 17 controls as well as some bracket and linkage assemblies.

New company gets going

In June of 1957 **Leeds & Northrup, Canada Ltd.,** was formed as a subsidiary of the Leeds and Northrup Co. of Philadelphia, Pa., U.S.A. and 22,000 sq ft of space was leased in the Toronto area for the new company. In August the leased premises were occupied and the acquisition of a Canadian staff undertaken.

Initial production was achieved in November. The new company is engaged in the manufacture and sale of two lines of recording and control instruments developed by the parent company, to which other lines will be added subsequently.

Packaged master control for broadcast

Visitors to the IRE Canadian Convention had an opportunity to see the new broadcast control equipment designed and built by **McCurdy Radio Industries Ltd.** This is a packaged master control assembly for use in the studio of am broadcast stations. It can be installed in about 4 to 12 hours and contains tape decks, amplifiers, controls and any specials required by the station.

Another significant development started in late 1956 and reaching full status in 1957, was the manufacturing agreement between McCurdy Radio Industries and McIntosh Laboratory. The latter's products are now manufactured by McCurdy in Canada, including the new commercial version of the McIntosh 31 amplifier designed for standard rack mounting.

TV the world over

	Sets	Stations
United States	44,500,000	500
Great Britain	7,500,000	21
Soviet Union	3,000,000	30
Canada	**2,800,000**	**43**
West Germany	1,100,000	39
Japan	650,000	16
France	600,000	19
Italy	575,000	90
Cuba	300,000	18
Mexico	300,000	10

Increased servomotor production

The Stratford, Ontario, plant of **Muirhead Industries Ltd.** is now manufacturing 400 and 60 cycle MIL and Commercial Specification Synchros sizes 23, 18, 15 and 11; Electrosensitive Recording Paper, Frequency Bridges; Deflexion Yokes. Repairs are carried out on all types of Magslips and Synhcros and on Mufax Equipment.

In 1958 production will be initiated in the Stratford plant of Size 10 Servomotors and Size 08 Synchros in addition to present lines.

New building in '58

Steel for the new factory and offices of **R. H. Nichols Ltd.** is now up and the company expects to move in sometime during February, 1958. This expansion will provide larger manufacturing facilities to keep in step with the growth that took place in 1957 and which is expected to continue into 1958. It will also provide for expansion of the company's design facilities as conditions warrant it.

Work on tropospheric scatter

During the later months of 1957 **Northern Electric** started shipping tropospheric scatter equipment for the Bell Telephone Company of Canada and Quebec-Telephone, to be installed between Quebec, Clarke City and Goose Bay in Labrador, a distance of 460 miles.

Among other items Northern Electric is working on semiconductor development and emphasis is currently on the development of certain types of power diodes and switching type transistors. The company also has the "Snow White" program for the production of electron tubes and dry reed switches.

Intensive research

Specialists in the design, engineering and manufacture of frequency shift radio and wireline teletype communications systems, **Northern Radio** of Ottawa have wide experience in these fields.

Highlight of the past fiscal year's operations was the development and production of all of the multi-channel voice frequency f-m carrier telegraph and narrow band doppler processing systems for the RCAF for use on the Mid-Canada Early Warning radar line.

Total value of products manufactured and sold in the Canadian plant was $675,000 for the fiscal year ending May 31, 1957.

Selling parts to U. S. A.

Mr. Simoni, general manager of **Precision Electronic Components (1956) Ltd.** reported that a sales agreement was signed in late 1957 whereby they would ship precision resistor parts to the United States for assembly and sale. This will reach full operation in 1958.

Plant facilities, both floor space and tooling, were increased during 1957 to permit the manufacture of ¾ and ½ inch variable composition resistors. This will be extended again in 1958 to include ⅜ inch variables.

In 1957 Precision Electronics had a research contract from National Research Council to carry out reliability studies on variable resistors.

1958 sales picture bright

The industrial manufacturing and sales picture for **Pye Canada Ltd.** has never looked brighter said Advertising Manager D. Zand. With the advent of their fm communications equipment, the company optimistically looks forward to 1958.

Just recently, they expanded their facilities 50% by occupying the building adjoining their factory. The Telephone and Domestic Products Divisions were moved to the new quarters.

1957 saw the entry of Pye into the fm communications market and also marked the first full year in the marine market. Sales in the latter jumped appreciably due to the fact that the line of transmitters and receivers was complete and satisfied market demands.

The sales force was increased: J. P. Gordon was appointed general sales manager, and new personnel were added to the Vancouver and Montreal offices.

The TV Div. received its first station contract in 1957. CKBI TV, Prince Albert, Sask., will be completely engineered by Pye Canada Ltd. The new Pye image orthicon camera was also introduced in '57. In Montreal, the Communications Div. has just completed a major contract with Veterans Taxicab Co. to install nearly $100,000 of fm equipment.

'Too many optimistic statements made'

Eric Leaver, president, Electronic Associates Ltd., says that it is time the industry took a more realistic viewpoint of the situation in Canada.

"While I think the long range prospects are excellent for the industry and for our own company, it is my belief and, I would say, my concern that a great many unduly optimistic and irresponsible statements are being made about the state of the industry. I think it does the industry a lot of harm.

"One of the examples was the glowing view of the opportunities of the Canadian market that led to an influx of companies in television. Certainly, a number of the companies who were large enough to have a good market survey, set up plants and very shortly after withdrew when they found what the situation was really like. We often tend to forget that this country has only 16 million people and while we have a great rate of industrial expansion, it still is relatively small. We don't have the markets available here that they do have in other countries.

"We should try and be realistic about these things in fairness to the industry itself. I don't think we want to see the kind of thing happen here again, as it did in the past, when you had price cutting and irresponsible activities in an effort to keep too many people alive on too small a market."

Production of long range radar

During 1957, **Raytheon Canada Limited** added production facilities to what had been, up until then, essentially a design and development operation. A new plant in Kitchener was opened, providing approximately 10,000 square feet of area devoted to sheet metal fabrication, and the assembly and testing of electronics equipment.

Product lines have been extended to include Canadian representation for all Raytheon Manufacturing Company products and services.

During 1957 production started on the long range surveillance radar for the Department of Transport (AASR). At present the company is setting up a school to train Department of Transport operators and technicians in the operation and maintenance of the AASR equipment. Classes are scheduled to commence early in the new year.

Microwave equipment

In the communications field **RCA Victor Company, Ltd.** has come up with two significant developments in the past year. One was the development of the RCA designed CW-20 microwave equipment to a capacity of 120 channels, and this new equipment is now in suc-

cessful commercial operation in Canada. RCA Victor engineered microwave relay communication systems using these CW-20 equipments are now in successful operation in all of the provinces of Canada west of New Brunswick.

Another of the company's recent successful developments is the CTR-900 microwave relay equipment which is 24 channel battery operated relay equipment designed for continuous unattended operation for service on routes in remote areas where day-to-day service is not feasible.

In the television field the new TT6AL and the TT2BL Transmitters are now being built in the RCA Victor plant at Montreal for Canadian broadcasters.

Start production on crystal oven

C. R. Snelgrove Co. Ltd. started production on their new crystal ovens late in 1957. They make all parts except the thermostat and consideration is being given to designing and producing this component as well.

There was a general shift in business trends during the past year with commercial sales accounting for a larger percentage of the crystals produced. Mr. Snelgrove has predicted keener competition for the coming year but with little change in the volume of business.

Will start manufacturing in Canada

Sola Electric (Canada) Ltd., formed in 1956, will start their manufacturing operations in Canada during 1958. Initially this will be on products for the lighting industry with electronic products considered for later on. Meanwhile, the electronic products made by the parent company will be sold in Canada. During 1957 a project was initiated to redesign all the standard products of the company; this will be completed by mid-'58. New designs have also been undertaken for regulated d-c power supplies using silicon rectifiers. These are both the fixed and the adjustable output voltage types.

Expanding field sales

Stanwyck Coil Products Ltd., of Hawkesbury, Ontario, was started in 1953 to serve the Canadian radio and TV industry with rf and if transformers and coils. With an increasing volume of business they appointed the Lake Engineering Co. Ltd., of Scarborough, Ontario, as their sales representatives at the beginning of 1957.

The company has now entered into the field of relay and clock coils, resistance wire elements and an increasing complexity of military and commercial rf coil assemblies.

Among the latest developments have been completely encapsulated rf coils and transformer assemblies to withstand severe environmental conditions. This has been done with their associated firm, the Hawkesbury Wire Co. Ltd.

The company expect to make bigger contributions in this field early in 1958.

Start manufacturing in Canada

The Telegraph Condenser Co. (Canada) Ltd., began manufacturing their capacitors at the new factory in Canada during 1957. In conjunction with this they are now initiating a program of development work to bring out new products in 1958.

Distance measuring device

Tellurometer Canada Ltd. was formed in June, 1957, to handle Canadian distribution for the parent company, Tellurometer (Pty.) Ltd. of Cape Town, South Africa.

The Department of Mines and Technical Surveys and the Department of National Defense have placed orders for substantially more than the total of 1957 sales for delivery early in 1958. The company's head office is presently located in Toronto. It is anticipated that an Ottawa office will be opened in 1958. There is also a possibility of Canadian development and manufacture being initiated in 1958.

Now an independent company

Tinsley Instruments, in 1957, concluded the purchase from H. Tinsley & Co. in London, England, of all the assets of the company in Canada and set up a new plant in Smiths Falls, Ontario. Sales of laboratory instruments during 1957 will show a 55% increase over 1956.

The company has developed a range of miniature wirebound high resistance potentiometers for use in computors and airborne navigation equipment. They have also worked with NRC on several new types of instruments, particularly in the field of precise thermometry.

During 1958 the company expects to introduce a new portable measuring potentiometer of approximately one third the size of the present one and also a new miniaturized Kelvin bridge for industrial use.

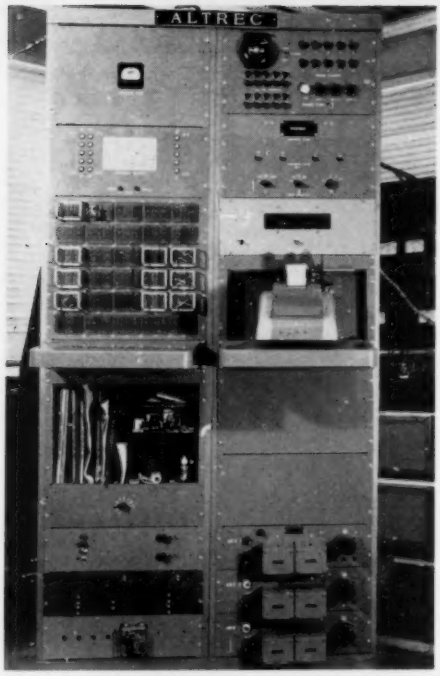
Trend is to transistors

Much of the design work being done at **F. V. Topping Electronics Ltd.** at the present time emphasizes the use of transistors. They expect to be the first company in Canada to design and manufacture a transistorized communications set: this is scheduled for 1958.

During the past year they have developed a number of power supplies and converters, both d-c and a-c. They also had a government contract to do a reliability study of airborne equipment and have increased their staff, primarily with technical and skilled personnel. For 1958 they have contracted to increase their production floor area.

Exporting resistors to the U. S.

Manufacturers of precision resistor components, principally film type deposited carbon resistors, **Welwyn Canada Ltd.** is reversing the trend of imports by exporting their components to the U. S. market. Well over three quarters of the output of the plant goes to the American market.



Altrec by Canadian Marconi is a system for automatic life testing and recording of electronic components

The company's efforts in 1958 will be directed almost entirely toward a program of automation. Bulk of the production finds its way into precision electronic gear such as computors of all types and guidance apparatus for the missile industry. As such they look forward to considerably increasing demands in 1958.

This year new lines will be introduced offering even more stability in the metal film type of resistor.

Wider uses for batteries

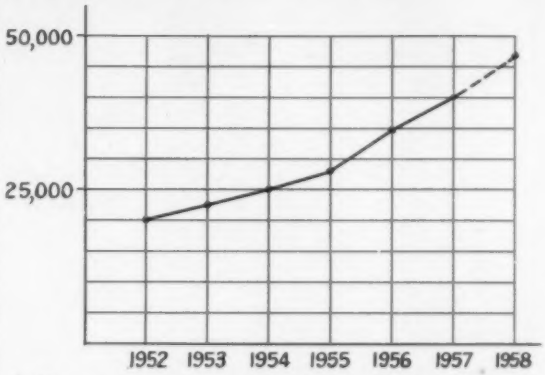
Products of **Union Carbide Canada Ltd.** include alloys and metals, carbon products, chemicals, industrial gases, plastics and consumer goods such as flashlights, batteries and anti-freeze. Over-all sales in 1957 were somewhat higher than in 1956 and indications are that the company's business in 1958 will approximately equal that in 1957.

The year 1958 should see a continued shift in end-use emphasis from batteries for non-portable radios to batteries for portable radios and other portable instruments. Greater sales of "Eveready" energizers are foreseen as the advantages of transistor-operated hearing aids over conventional hearing aids become more widely known.

In the field of plastics reduced sales of appliances may influence the sale of phenolic laminates, widely used for radio, television and other electrical insulation purposes and printed circuits.

On the other hand a substantial increase in sales of polyethylene is forecast for 1958. A major end use of polyethylene is in wire and cable as a superior insulating and jacketing material both in the communications and electrical power fields.

Growth of radio in Canada



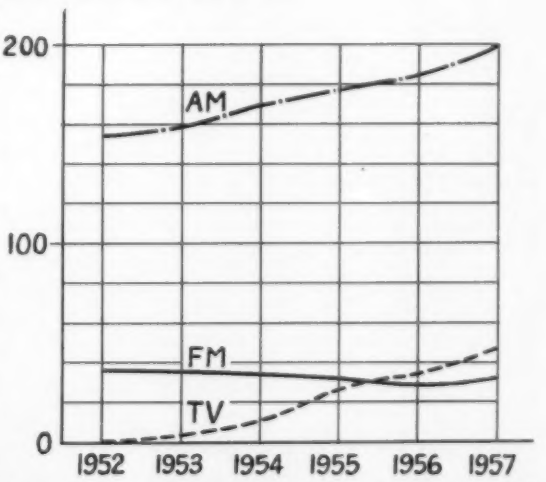
Radio transmitters in Canada have doubled in five years. Rate of increase is now 6,500 a year. Source DOT

Telecommunications and broadcasting

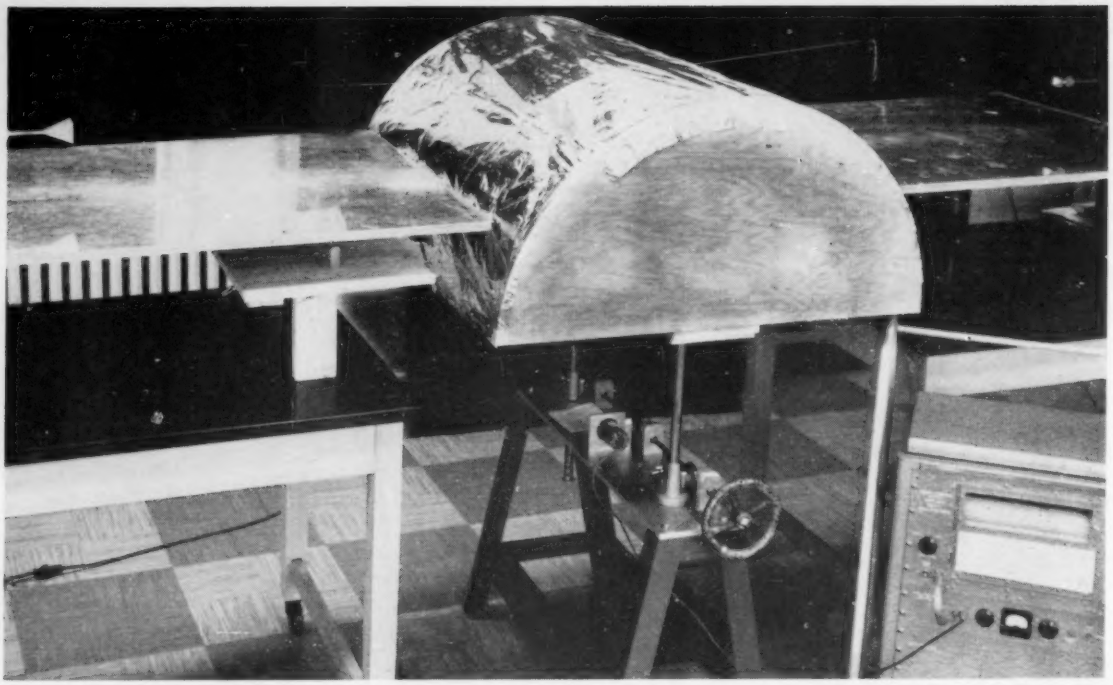
The charts shown here illustrate the very rapid growth of radio in Canada. The upper chart gives the number of licensed transmitters in Canada, excluding some military and other government equipments, and shows a doubling from 20,000 to 40,000 in the five years from 1952 to 1957. Present rate of increase is 6,500 per year and even this is growing — it is expected to be 7,500 per year in a year's time. The Department of Transport has recently made a ten-year forecast and envisages a total of about 190,000 transmitters in operation in 1968.

In the other chart, the growth of broadcasting by both the CBC and private companies can be seen. Present totals are: AM standard band stations, 200; FM stations, 32; TV stations, 47 (including three satellite stations, two in British Columbia and one in Newfoundland). In addition, there are 42 AM short wave transmitters (34 CBC and 8 private).

Broadcast stations



Curves show number of AM (standard band) radio, FM radio and television stations in Canada. Source DOT



Model transmission links with a smooth cylindrical mountain between transmitter and receiver

Mountains increase radio reception

DR. M. P. BACHYNSKI*

Large obstructions such as mountains in propagation paths can be used actually to increase short wave radio signals received over long distances. This paper deals with the effects of such an obstruction and what can be learned about this phenomenon from scale model experiments.

The notion of a large natural obstruction as being an impermeable barrier to short radio waves has existed for a long time. Even over a smooth terrain, the field at the receiver decreases rapidly as the horizon is approached in a direction away from the transmitter. As a result of the curvature of the earth the transmitting and receiving stations become hidden from each other at relatively moderate separation distances and calculations considering the earth as a smooth sphere predict large attenuations of the receiver signal in this shadow region.

However, long range propagation experiments conducted over the last few years have shown the presence of relatively large fields beyond the horizon as well as behind local natural obstacles such as mountains. These increased fields are the result of mechanisms of propagation which have their origin in the atmosphere or occur as a result of the effect of terrain irregularities on the propagation of short radio waves.

Turbulence of the atmosphere causes variations of the dielectric constant. Hence, forward scattering of energy in the direction of the receiver takes place from the zone of the troposphere situated within the intersection of the beams of the transmitting and receiving antennas. Erratic variations of the dielectric constant are considered responsible for the rapid fading of the observed signals. With a dominating obstruction situated between a transmitter and receiver station (fig. 1), and with favorable geometry (i.e. transmitter-receiver height, frequency, separation distance, obstacle height, etc.) the loss of energy due to this mountain can be very small. In fact, it turns out that this loss can be much less than that which would result if the energy were propagated over a smooth spherical earth with no obstruction and also several orders of magnitude less than which is possible by a tropospheric scattering process.

The meaning of "obstacle gain"

Because of this increase in received power, the term "obstacle gain" which is defined as the ratio of the actual field strength to that calculated for a smooth spherical earth has been coined. The received signal is, of course, less than that expected for the case of free space propa-

*RCA Victor Company Ltd., Montreal

gation, so the "obstacle gain" is actually a decrease in the loss expected for transmission over a smooth earth—it is a "gain" because the loss is not as great!

Spectacular occurrences of this phenomena have been observed in nature on a number of occasions. Some Japanese workers[1] in 1953, measured the field 180 kilometers behind Mt. Fuji from a transmitter on the opposite side of the mountain and measured a signal which was 85 db above that which they calculated. About the same time, two stations in Alaska which are 160 miles apart and which have an obstruction of 8,000 ft. (Mt. Fairweather) approximately midway in their path observed an "obstacle gain" of 55 db[2]. Furthermore, their signal showed very small fading effects of only $\pm$ 2 db variation.

More recently some observations have been made over four paths separated by about 100 miles at frequencies ranging from 60 mc to 1050 mc. One propagation path was directly over the summit of Pikes Peak[3] which is over 14,000 ft. in altitude. All of the paths except that for which the propagation was nearly directly over the summit of Pikes Peak exhibited high values of basic transmission loss and severe fading with time. An obstacle gain of 29 db and a marked reduction in fading was the effect produced by Pikes Peak.

The practical importance of obstacle gain is at once apparent. Thus if this phenomena can be utilized it would be possible to transmit over extended ranges without the aid of relay links. The slight fading observed in practice indicates that the reception would be much more reliable and less distorted than that which is possible at the same distances over a smooth earth or that observed as a result of an atmospheric scattering process. In addition, communications could be provided over paths in mountainous regions and rocky terrain where direct links and wire communications are impractical because of the difficulty of construction and maintenance. This is particularly true for regions of Switzerland, Japan, and the Rockies of British Columbia. Finally the military significance of obstacle gain should not be overlooked. As indicated earlier, the effect of the obstruction in the propagation path is to produce localized regions of intense radio power. Such a system is thus extremely difficult to jam because a second station operating at the same frequency but propagating over a different path to a common receiver is likely to suffer substantially different transmission loss. Hence, suitably engineered point-to-point communication systems utilizing obstacle gain are desirable for military purposes.

Although "obstacle gain" is an effect which shows up most spectacularly for very high obstructions, it nevertheless occurs to a lesser extent for smaller hills and rolling country. In order to harness this phenomena adequately, the field engineer would like to be able to predict beforehand the effect of a particular topography on the propagation of radio waves and hence ascertain his optimum transmitter and receiver positions or alternately the power expected if the location of the transmitter-receiver stations is specified.

Calculating received energy

One very simple picture which has agreed with experiment in some instances has been the following: The large dominating obstruction is replaced in theory by an opaque knife edge of equivalent height which is assumed to extend to infinity in the directions perpendicular to the energy propagation. The transmitter and receiver are located on opposite sides of the edge and the energy from the transmitter which is picked up at the receiving station is calculated from Kirchoff's diffraction formula based on Huygens' Principle. What this means essentially is that every point in the vertical plane above the edge is illuminated by the transmitter and acts as a secondary source of

Fig. 1. Mountain between transmitter and receiver may result in "obstacle gain" at the receiver

radiation. Its phase is given by the distance it has traveled in coming from the transmitter. The phase of the secondary radiation when it arrives at the receiver is given by the path length taken to get from its position above the edge to the receiver. The plane over the obstruction is divided into many narrow strips and all the contributions with their correct phases are added at the receiver to produce the incoming signal.

A portion of the power illuminating the region above the edge will have arrived there after being reflected from the earth's surface. In other words, some of the energy follows the direct path while other energy arrives via a reflected path. The same is true on the side between the receiver and obstruction. Thus, there are four possible ways (fig. 2) by means of which the field is propagated from transmitter to receiver, namely by diffraction directly above the edge, by a reflection on the transmitter side of the edge and diffraction at the edge, by diffraction at the edge and reflection on the receiver side and finally by reflection on the transmitter side, diffraction and reflection again on the transmitter side. This results in a four-ray knife-edge theory where the phases of these four components can be calculated by assuming the rays to travel from the real transmitter or its virtual image to the real receiver or its virtual image and include any phase charges which may occur upon reflections. The effect of each component is calculated from Kirchoff's formula as indicated and the total received field is obtained from a summation of the four components.

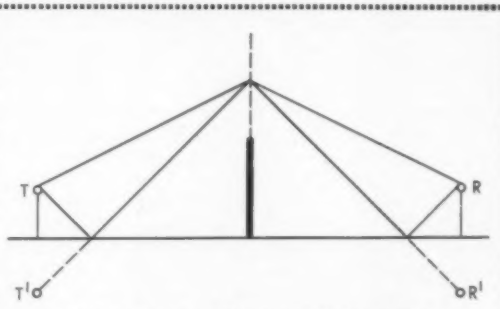


Fig. 2. Four possible transmission paths

The path lengths along the four-rays are different producing an interference effect. A typical behavior of the received field intensity as a function of obstacle height for fixed transmitter-receiver heights and separation and a fixed frequency is shown in fig. 3. The earth is assumed to be a perfect reflector. It is observed that only for a specific geometry is optimum obstacle gain attained. In fact, it is possible to make an unfortunate choice of the parameters so as to end up in one of the minima and hence a negative "gain" will result. The effect of varying the parameters (frequency, antenna heights, separation of the stations) is to shift the positions and alter the spacing between the maxima and minima. The general behavior is however, as indicated.

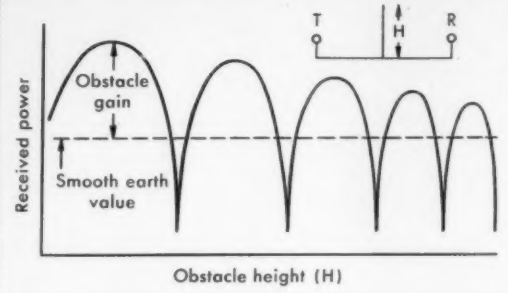


Fig. 3. Typical behavior of the received field intensity as a function of obstacle height

It is apparent that the geometry of the practical transmission link is quite critical even under idealized conditions and it is not surprising that this simple picture fails to predict the results obtained in many cases[4]. Basically the four-ray idea is too simple. Anyone who has passed through a mountainous region will immediately foresee its shortcoming. Mountain ranges do not extend at a constant height along a particular direction as do idealized knife edges. In reality the obstacles can take the form of half-cylinders, wedges, ridges of approximately parabolic cross-section, slanted ridges, cones both sharp and truncated, paraboloids of revolution and so on. In rugged mountains it may happen that the greater portion of the radiation is bounced back from the sides of a slope and passes through a valley rather than diffracted over the crest of the ridge.

Effect of rough surface

In addition to the diffraction problem there is always the question of whether, where and how strongly the reflections occur. The surface roughness and the ground parameters such as the conductivity and dielectric constant have a marked effect on the reflected energy. It would be of great aid to the communications engineer to know how rough the reflecting surface must be before the reflected energy can be neglected or the degree of roughness for which the reflection coefficient is still virtually unity. In fact, with all the complications introduced by a practical terrain, it is surprising that the four-ray theory predicts any sensible results at all. Thus a more refined approach to the problem than that afforded by the 4-ray theory is essential.

One method of learning more about obstacle gain phenomena is to carry out experiments in the field. The greatest drawback is that it is virtually impossible to vary the most important parameters such as the size, shape and location of the obstacle. The topography and electrical constants are fixed for a given terrain and cannot be altered. The only variable which can be changed systematically with relative ease is the height of the antennas. In addition, the establishment of suitable experimental transmitter-receiver stations is extremely costly. Finally, random features of the terrain, irregular obstructions and atmospheric effects may combine to form such a complex phenomena as to make a theoretical correlation difficult if not impossible.

A more satisfactory method of investigating obstacle gain appears to be through the use of scaled models of transmission links. In this manner each aspect of the problem can be isolated and by a separate deciphering of each particular phenomena a better understanding of the propagation process can be achieved. Topography such as knife edges, half-cylindrical mountains, parabolic cylinders, multiple obstacles, surface roughness, etc. can be simulated. In each instance the model approaches closer and closer to the conditions actually encountered in the field. Such parameters as radius of curvature of the model earth, surface conductivity, transmitter-receiver heights and separation, shape, position and height of the obstacles, polarization, frequency, and transmitter directivity can be readily controlled. Once theories are established which accurately predict the results of the model experiments, they can be applied with greater confidence in the field.

Since the vertical knife edge does not in reality simulate the contours of a typical mountain, a better approximation to the true conditions is realized if the edge is replaced by a perfectly conducting obstruction which is capped by a smooth half-cylinder. Experimental model transmission links with a smooth cylindrical mountain located between the transmitter and receiver stations are depicted in the photograph. Model experiments on these mountains with smooth cylindrical crests have yielded some surprising results. For example it is found that if the energy incident on the mountain is vertically polarized, the obstruction appears lower than it actually is to a receiver located on the opposite side of the mountain from the transmitter. If the incident energy is horizontally polarized the mountain appears higher to the receiver. These results can be explained in the following way. In the case of horizontal polarization the electric field is zero at the crest for a perfect conductor and since the field cannot be discontinuous it can attain its full value only at a certain distance above the crest of the mountain—hence the mountain appears higher.

More from vertical polarization

In the case of vertical polarization, the field spreads over the crest and produces a "halo" region. Surface currents are set up not only on the illuminated side, but also on the shadow side. As a result the mountain appears to be lower. Thus it is found that the shadow region behind a smooth cylindrical mountain appears "brighter" (i.e. more energy is received) if the incident field is vertically polarized and "darker" if the incident energy is horizontally polarized. In addition, for vertical polarization, the larger the radius of curvature of the mountain, the "brighter" is the shadow regions. The opposite is true for horizontal polarization, the shadow region becoming "darker" as the radius of curvature increases.

If the surface of the cylindrical mountain is rough rather than smooth the resultant energy in the shadow region is reduced in the case of vertical polarization and increased for horizontal polarization.

It has been possible to correlate all these effects with a suitable theory[5] which can be applied to practical situations. Thus the field engineer is one step nearer to predicting the effects under the conditions which exist in reality. Future investigations on still more complex models will further the establishments of obstacle gain as one of the arts of communications engineering. END

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Circular shape and position of stage in the Stratford Festival Theatre raised many acoustical problems

Inside the Stratford Festival Theatre

Special ceiling design helps solve main acoustical problems

*R. H. TANNER

The permanent Stratford Festival Theatre follows closely the lines of the original tent. The circular shape and the unique stage offer many acoustical design problems. These were overcome and actors say they do not find the theatre tiring to play in—an indication of very efficient use of the sound energy available.

Although the study of architectural acoustics dates back to very early times, at least to the days of Ancient Greece, its scientific interpretation is much more recent, and may be said to have begun with the work of Prof. Wallace Sabine in the last few years of the nineteenth century. Prior to that time, the acoustics of a building was normally left to chance, or at best was dealt with by imitating some other structure known to be successful. But, unfortunately, since slavish imitation can hardly be called good architecture, variations were almost always introduced which often were sufficient to play havoc with resulting acoustical conditions.

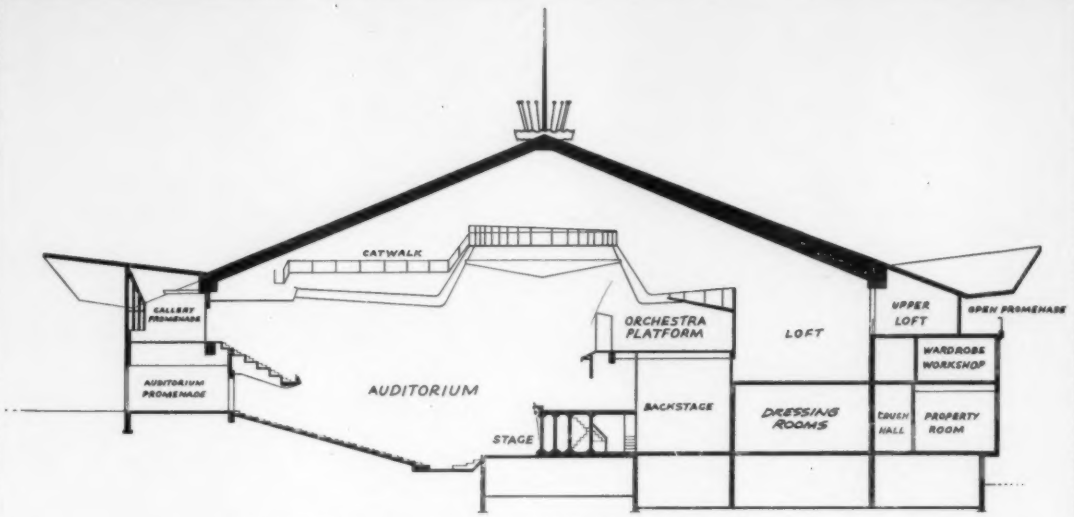
During the last 50 or 60 years a great deal of work has been carried out on this important subject, with the result that the acoustical characteristics of a projected building can now be predicted with very considerable accuracy, and the acoustical perfection of the final result is governed mainly by the expertness and judgment of the designer, the time (and money) allocated to the investigation of details, and the fidelity with which the design is translated into concrete form. In view of this, it is somewhat surprising that even today so many important buildings are erected with apparently very little thought being given to the acoustical aspects of their design.

In the case of the new permanent theatre for the Stratford Shakespeare Festival Foundation of Canada, acoustics was among one of the first matters to be considered and active design work started in November, 1955, nearly two years before the theatre opened its doors to the public. However, in view of the special nature of the building, and the tradition of production and acting which had already been established by the unique stage of the original tent theatre, acoustics was by no means the most important factor in the over-all architectural design as it was, for instance, in the London Festival Hall or the two new Alberta Provincial Auditoriums. In other words, it was decided, right from the start that the new theatre would follow very closely on the lines of the tent, using virtually the same seating and stage, maintaining the unusual combination of Greek and Elizabethan theatrical traditions. This arrangement was selected partly to keep the maximum intimacy between the audience and the action, since no seat was further than 55 feet from the stage.

Increase in ceiling height

In the design of the new theatre, the angle subtended by the seating was reduced from 230 deg. to 190 deg.; to make up for this loss in accommodation, a small seven-

*Northern Electric Co., Ltd., Belleville.



Architect's cross-section drawing of the Stratford Festival Theatre

row gallery was added to give a total seating capacity somewhat greater than that of the tent. The inevitable result of this was that the height of the ceiling had to be increased together with the over-all volume of the theatre.

The fact that the theatre was to be completely round in plan, with the centre in the middle of the acting area, raised the first major acoustical problem, since the first commandment of acoustical design is "Avoid all concave curves." There must obviously be very little reflection of sound from the circular rear wall or the actors would hear everything they said echoing back to them, with more than 1/10 of a second delay. Since the intensity of this echo would be enhanced by the focusing effort, it might well have the effect of making coherent speech almost impossible.

A second problem arose from the location of the stage with the audience on three sides; actors would often be speaking with their backs turned to a large portion of the house. Since human speech is markedly directive, especially as far as the higher frequency components are conceived, this state of affairs would result in poor intelligibility unless a way could be found to reflect these high frequencies to the section of the audience concerned with sufficiently small delay to avoid the production of a distinct echo.

A third problem was posed by the fact that the unusual design of the theatre did not allow for the provision of a conventional orchestra "pit." Since music has always played an important part in Stratford productions, and although in the tent no really satisfactory location had ever been found for the musicians, it was obvious that in the new theatre a location would have to be found for the orchestra so that it did not interpose itself between the actors and the audience (as it tends to do in a proscenium theatre). Ideally, the music should have no closely defined source, yet should be efficiently transmitted to all parts of the building so that even a small group could fill the large auditorium.

In addition to these three problems which were special to this particular design of building, the acoustical design had to fulfill the more normal requirements of (1) providing the optimum reverberation time over the frequency range, (2) giving good dispersion and efficient transmission of sound to everyone of the 220 seats, (3) avoiding all long period reflections which might give rise to echoes and (4) excluding all external noise.

Reflection of high-frequency consonants

The first stage in the solution of these problems was the design of a ceiling which would not only do what was required acoustically but which would also be acceptable to the architect. The design finally arrived at appears to meet both these requirements, and is in fact one of the outstanding features of the theatre interior. Although many visitors have commented on the fact that it "Keeps the feeling of the tent" this is mainly a matter of coincidence, since both the flat portion and the steeply sloping curve toward the centre (both of hard plaster) were selected for acoustical reasons. The former reinforces the sound in the balcony, while the latter has been carefully calculated to give the desired reflection of the high frequency consonants to the section of the audience behind the actor. The outer ring of the ceiling is at present made of cloth owing to lack of time; but in due course this will be replaced by a sound-absorbent ceiling.

The problem of making the rear wall of the auditorium sound absorbent was more an economic than an acoustical one. The normal treatment of a thick pad of mineral wool covered by a sound-transparent facing would have added considerably to the cost, owing to the unusually large area to be covered. Instead, the whole wall was built of a light aggregate cement block, with an open surface texture, giving sound absorption coefficients in excess of 0.6 from 125 cps up. For the sake of appearance, the wall was faced with perforated steel panels painted dark blue to match the rest of the interior. Since the comparatively large number of entrance doors set in this wall would have caused trouble if faced with reflecting material, they were filled with mineral wool, covered with an open weave cloth.

The wall immediately behind the stage was given a zig-zag form for both architectural and acoustical reasons. Being faced with sheets of polished plywood, these angled surfaces help to reinforce and disperse the sound throughout the auditorium. On either side of the stage, the facing is of hardboard, again to give reflection and reinforcement.

Inside the theatre; no seat is further than 55 ft from the stage

As in all auditoriums, the audience itself is one of the most important acoustical factors, but one which is unfortunately outside the designer's control. So far, the success of the Festival has been such that the design was based on the assumption of capacity houses: however, just in case attendance should ever drop, the seats are designed to give as nearly as possible the same acoustical absorption as an average member of the general public. The seats, which are comfortably padded with foam rubber, were in fact especially designed for the Festival Theatre, and won a Canadian Design Award. The floor of the auditorium is covered with latex backed carpet.

The location of the orchestra was a matter resolved only after considerable discussion between the architect and acoustical designer. It was finally decided to place it above and behind the stage, in such a position that the ceiling would serve to disperse the sound throughout the theatre; at the same time, the acoustical characteristics of the orchestra loft could be made somewhat more live than those of the auditorium itself, to enhance the tone and produce good blending.

Target figures for reverberation

In the tent, the problem of external noise was quite a serious one, with train whistles, rain and the shouts of spectators watching baseball and football in the fields below the theatre proving the most important sources of interference. The construction of the new theatre is, of course, of great solidity, and far greater attenuation of outside sounds could be expected. The main sources of concern were the doors into the auditorium, for which neoprene gaskets were specified, and the wall between the theatre and the backstage areas, which was made of heavy masonry. In addition all the walls backstage were constructed of open texture cement block to absorb as much sound as possible.

In working out the design of the theatre, target figures for reverberation times were set at 1.8 seconds for 125 cps., and 1.2 seconds for frequencies of 500 cps. and above. Measurements have been made in the empty theatre using the technique of recording a series of pistol shots and playing the resulting tape back through bandpass filters. After correction for the effects of the audience, the measured results were 2.0 seconds at 125 cps., 1.2 at 500 cps. and 1.0 at 2,000 cps. The fact that the period is somewhat longer than the design figure at low frequencies is probably due to the fact that owing to time limitations, perforations were omitted from the hardboard panels on either side of the stage. The discrepancy at the higher frequencies is due to the combination of audience absorption and the very large absorptive rear wall. In general, however, the agreement is very good and the performance of the theatre indicates that close to optimum conditions have been achieved.

The treatment of the rear wall has been extremely successful in preventing the focusing of echoes back to the stage. Pulse tests originating at the centre of the theatre produced no audible echo, and exhibited as smooth a die-away as any other location.

Approximate measurements were also made of the level distribution throughout the theatre. Unfortunately, a warble tone oscillator was not available, so that the results obtained were adversely affected by the presence of standing waves. However, they are sufficient to indicate a very even distribution of sound over the entire auditorium.

Objective impressions of the performance of any auditorium are very hard to assess, being subject to so many extraneous and imponderable factors. In the opinion of many expert listeners, the new theatre has proved itself most successful, particularly bearing in mind the facts that its volume is over 250,000 cu. ft., and that even a trained actor cannot generate more than 100 microwatts of speech power for more than a short period of time. In spite of these, the actors do not find the new theatre tiring to play in, an indication that it makes very efficient use of the sound energy available. The highly experimental orchestra location has proved extremely successful, resulting in music which permeates the whole theatre with no very obvious source, providing a true and unobtrusive accompaniment to the plays. END.

For your library

How industry can use plastics to get the best results

Engineering Properties and Applications of Plastics

Gilbert Ford Kinney, John Wiley and Sons, Inc.; 278 pp.; $6.75.

Reviewed by: F. B. Fisher, Canadian Westinghouse Co. Ltd., Hamilton, Ont.

In his first chapter Dr. Kinney suggests that plastics pose a problem for the practising engineer: "How can one best utilize plastics, taking advantage of their desirable properties, while minimizing the effects of their natural limitations." His book provides much of the background information necessary to solve this problem and, in so doing, bridges a gap that has existed in plastics literature between books dealing with high polymer theory and those which are largely limited to discussing a specific technique or to listing mechanical or electrical properties.

The author succeeds in getting across the engineering information against a background of plastics chemistry. The first twelve chapters deal with the various chemical types of plastics, starting with the simplest thermoplastic and working through the more complex thermosetting plastics and rubber. Chapter 13 discusses molding methods and Chapters 14-17 cover the engineering, thermal, optical, and electrical properties respectively. Chapter 18 gives a brief but helpful summary of the chemistry of plastics and the final chapter gives some comparative tables of characteristics and applications.

The book as a whole is written in a very easy style and is singularly readable.

Installing electronic data processing systems

Richard G. Canning. John Wiley & Sons Inc.; 193 pp; $6.

The initials EDPM stand for Electronic Data Processing Machines. Quite often organizations that have become involved in the problems of installing the machines have their own definition of the same letters—Every Damn Problem Magnified.

Mr. Canning's book should do much to clear up any illusions about EDP that exist. It covers the significant questions of fitting EDP into the organization, selecting and training EDP personnel, programming, physical installation of the system and the early phases of operation.

It is a practical book written in non-technical language and assumes that the reader is relatively unacquainted with electronic computers. It deals with the efficient installation of EDP and at the same time is a guide that will be read at a high management level.

The book deals with all aspects of EDP systems—what are the important and expensive factors and how to control costs effectively. Studies of a number of companies in dissimilar fields have been synthesized into a single case history .

Ideas, Inventions & Patents

Robert A. Buckles. John Wiley & Sons Inc.; 270 pp.; $5.95.

This is an excellent, easy-to-read book which answers the sort of questions that go: "What should you do when you get an idea for an invention?" and "How can patents keep you up-to-date on technological progress."

Mr. Buckles is a graduate engineer who later went on to take law gaining an LL.B. He is now a practising patent attorney and member of the New York Bar.

In the book he discusses the principles that underlie patents in all fields of technology—mechanical, electrical, chemical and nuclear and then gives lucid examples of specific applications in each area. In addition he gives a step-by-step case history of a simple invention and tells how some of the patents on inventions at the turn of the century were made.

For instance Bell and Elisha Gray both filed patent applications on Feb. 14, 1876, claiming their independently conceived inventions of the telephone. Edison, Fleming and De Forest were all interested in the same related patent field while Edison's original patent of the phonograph or speaking machine, which using "hill-and-dale" recording, was sufficiently broad to cover Berliner's gramophone which had laterally cut grooves.

This book is an authoritative source book for training programs in industry as well as giving inventors and business men a new insight into the world of patents.

How to make good tape recordings

C. J. LeBel. Audio Devices Inc., New York; $2.50.

This new handbook covers all the details of tape recording in a non-technical manner. It includes advice on how to select a tape recorder, and the tape and then goes into the details of the acoustic problems involved with microphones, the studio and stereophonic work.

In addition to Mr. LeBel's material there are three chapters by specialists in their fields: microphone recording by Vincent J. Liebler, Columbia Records Inc.; tape editing, by A. A. Pulley, RCA Victor and the use of sound effects by Herman H. Haverkamp, Radio Station WNYC, New York City. Mr. LeBel himself is president of Audio Devices and secretary of the Audio Engineering Society.

Catalogues and brochures from the manufacturers

X-ray instrumentation; 12-pp. catalogue information. Philips Industries Ltd., Toronto. (101)

E-Z-Code wire markers. 12-pp. brochure describes the self-adhering markers for wire and small components. Northern Industrial Products, Toronto. (102)

Loudspeaker catalog describes loudspeakers, systems and enclosures. 12 pp. University Loudspeakers, Inc., White Plains, N.Y. (103)

Speed measurement to high accuracy. Four brochures, GET-2741 (1-2-3-4) describe four methods. Canadian General Electric Co. Ltd. (104)

Test equipment catalogue K-1 describes Boonton products. Bayly Engineering Ltd., Ajax, Ont. (105)

Film catalogue. 16-page listing of 16mm films available on loan from Canadian General Electric Co. Ltd. (106)

Microwave equipment and applications booklet with reference data by De Mornay-Bornardi. Bayly Engineering Ltd., Ajax, Ont. (107)

Miniature indicators, transistor circuit and switch light indicators. 6-page catalogue. Eldema Corp., El Monte, Calif. (108)

Parallel plate capacitors, type HFP, water cooled, high frequency. Two-page bulletin GEC-1482. Canadian General Electric Co. Ltd. (109)

Cinema-Television Ltd. instruments are described in an eight-page catalogue—frequency monitors, counters, bridges, generators, etc. Dawe Instruments Ltd., Ottawa. (110)

Design and application data on Type C Hipersil cores for electronic equipment transformers. Canadian Westinghouse Co. Ltd., Hamilton. (111)

CANADIAN ELECTRONICS ENGINEERING

Volume 1

1957

Index of technical articles

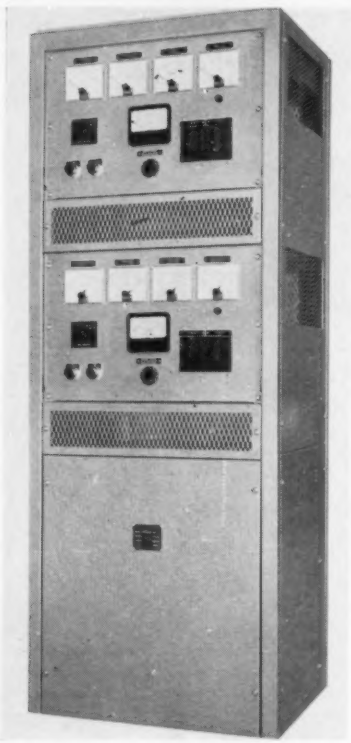
Subject index: Classifications used in this index correspond to the Professional Groups of the Institute of Radio Engineers (IRE). Articles are arranged alphabetically under each classification.

Author index

This index is arranged in alphabetical order of names. A name followed by "and" is that of the first author of a jointly written article, while the word "with" indicates that the name indexed is that of the second or third author.

Silver cell battery charger has range of 1 to 5 amps dc

Each magnetic amplifier-silicon-diode-module of this automatic constant current battery charger supplies an adjustable output of 1 to 5 amps dc, ± 1%. The current is constant into a silver cell battery system ranging from 1 to 50 cells. This permits automatic charging of many types of cell configuration with the same charging unit. Automatic shut-off is provided by the four meter relays. Other units are available.



Lee Electric & Mfg. Co., Los Angeles, Calif. (112)

Bobbinless wire resistors

Resistance elements and contacts are embedded in epoxy resin and have a smaller space factor because no bobbin or winding form is needed. Wire strain is eliminated and permanent change in resistance is less than 0.2% under most conditions. Tolerances down to 0.05% are available in a wide range of standard sizes depending upon resistance value. Closer tolerance or matched multiples are available upon request. The resistors have low conductance and low capacitance characteristics with reproducible uniform frequency response.

Resistance change with humidity (MIL-R-93 moisture resistance test) is less than 0.2%. Resistance change with temperature cycling (MIL-R-93) is less than 0.2%. Resistance change with load life or 100% overload (MIL-R-93) is less than 0.3.

C. C. Meredith & Co. Ltd., Streetsville, Ont. (113)

Epoxy casting materials

Four new additions have been made to the Hysol 6900 epoxy casting material series. These incorporate longer pot life, low viscosity and the elimination of settling. This facilitates handling and also provides flexibility which prevents cracking caused by temperature cycling and shock.

Hysol (Canada) Ltd., Toronto. (114)

Photocell operates in visible spectrum

The HD series photo cell will operate magnet and thermal relays without any intermediate amplifier. The resistance varies with change of illumination so that it has a resistance of greater than 1 megohm in the dark and only a few hundred ohms at a light level of 50 ft. candles. The electrode material is completely ohmic so that resistance remains independent of applied voltage.

In its standard form the cell comprises a sensitive area about ¾ in. x ¾ in. with a thin layer of cadmium sulfide in a sealed glass envelope. The HD series cell has response throughout the visible spectrum and continuous maximum permissible dissipation in excess of 600 milliwatts at 20 C. Temperature range is —40 C to +75 C; maximum voltage is 240 volts ac.

Canadian Marconi Co., Montreal. (115)

High speed electronic printer

The Stromberg-Carlson Model 5000 high speed electronic printer combines a charactron shaped beam tube and a Haloid Xerox Copyflow printer to provide print out of 4,680 lines per minute. Electrical impulses from a computer are translated into a display of numbers, letters and symbols by means of the Charactron shaped taube. Inside the tube an electron gun shoots its beam through tiny shaped openings which form the beam into characters. It reproduces 64 characters—the letters of the alphabet, 10 numbers and 28 symbols of the users choice. These are projected by an optical system onto the charged surface of the Xerox selenium drum. The latent images are developed by cascading dry powder and then printed on continuous rolls of paper or sheets.

Hackbusch Electronics Ltd., Toronto. (116)

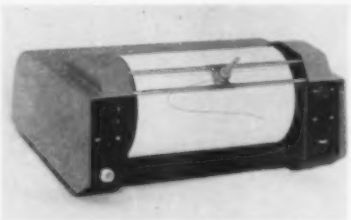
Aluminum mast is portable

Two men can erect this portable aluminum mast in less than one hour. All assembly work is done on the ground and the mast is designed for a maximum height of 150 ft. The masts are built to CSA standards and are supplied with a vertical radiator on an insulated base or with a grounded base.

Beatty Bros. Ltd., Fergus, Ontario. (117)

Digital X-Y recorder is transistorized

Model 560 digital X-Y recorder is capable of movement in both positive and negative directions on either axis. Both of the axes move in discrete increments of 1/100 in. at a maximum speed of 200 increments per second. It can also be operated as an empirical curve follower to supply information to a computer by removing a pen and replacing it with a curve following attachment.

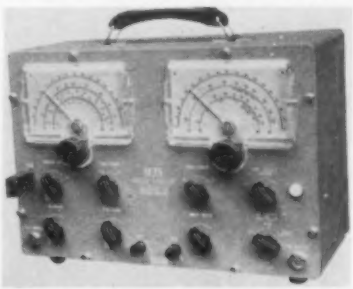


The error of this completely transistorized recorder is guaranteed not to exceed one half of an increment (0.005 in.) for the full travel on either axis. Paper size is 11 in. by 17 in. maximum and power required is 115 vac, 100 watts.

California Computer Products, Los Angeles, Calif. (118)

Sweep marker generator

Model SMG-57 is a combination sweep and marker generator designed for television service and alignment work. Sweep frequency range is 2-260 mc.; marker generator range is 3-225 mc.; marker generator accuracy is better than 1%; sweep deviation is variable to 12 mc.; output impedance is 75 ohms; output voltage is over 0.1 volt in three steps; crystal oscillator accuracy is 0.002%.



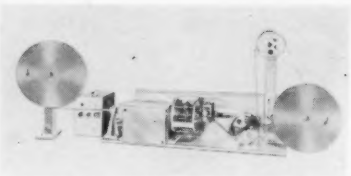
An internal crystal controlled oscillator at 4.5 mc provides for alignment of sound i-f and demodulator circuits. The instrument can also be used to align f-m receivers.

Stark Electronic Sales Co., Ajax, Ont. (119)

(Continued on page 44)

Machine winds resistance wire automatically

Model 209 winds resistance wire on continuous lengths of flat or round core material to be cut to any desired length and made into flexible wire wound resistors, heating elements, attenuators, rheostats, etc. The machine will wind upon any material that can be drawn through a 1/4-in. inside diameter spindle. It is a fully automatic machine with manual start and stop.



The wire sizes that can be wound are 0.0012 in. to 0.01 in. and winding range is 100 through 600 turns per inch. Thyratron variable speed control permits uniform torque in winding at speeds as low as 200 rpm and as high as 1,400 rpm.

A. Andrews, Port Credit, Ont. (120)

Crystal rectifier test set

Model 585 crystal rectifier set is designed to measure forward resistance, back resistance and reverse current of crystal diodes. Scales showing "good" or "poor" reverse current conditions are provided for diodes 1N21, 1N21A, 1N21B, 1N23, 1N23A, 1N23B; but any diode can be tested by using the "kilo-ohm" and "o-lma" scales and referring to its electrical specifications.

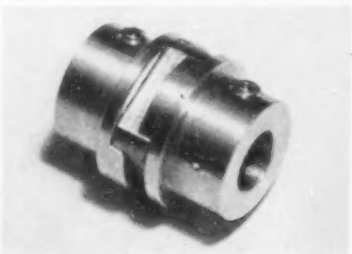
The test set is powered by a size D (1.5 volts) flashlight cell.

MEL Sales Ltd., Arnprior, Ontario. (121)

Precision couplings and gears

PIC Design Corp. has added a number of miniature couplings gear wheels and worms to their line of stock items. Illustrated is the type "T" coupling made of stainless steel with a nylon centre block. It is also available with an oil-less centre block and is available in pin-type and clamp-type hubs in bore sizes of ⅛ to ¼ in. diameter.

Other precision gears fully described in supplement catalogue No. 13 are: Type "G" 24 and 32 pitch spur gears available in stainless steel, nylon and phenolic materials with bore sizes ranging from ⅛ to ¼ in. diameter; type "Q" worms of stainless steel and wheels of bronze in 48 pitch single, double or quadruple threads; type "P" anti-backlash gears available in 24 to 200 pitches with bores ranging from ⅛ to ¼ in. diameter, made of stainless steel, aluminum and bronze.



PIC Design Corporation, East Rockaway, N.Y. (122)

New leads for avometers

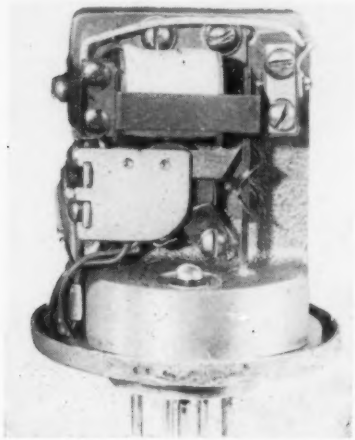
The terminals on the latest Avometers incorporate a jack in the centre post so that leads with either hook-on connectors or push-on connectors can be used. New leads are now available that plug into the terminal posts. The molded rubber shroud covers the entire terminal making the connection splash proof. Interchangeable and test prods are still used with the new leads. The hook-on style will still be available.

R. H. Nichols Ltd., Toronto. (123)

(Continued on page 45)

Vibrating reed relays

Vibrating Reed Relays for use in tone signalling and control systems are available in all frequencies from 100 to 1000 cps. The high effective Q of over 700 permits close spacing of tones. The relays are hermetically sealed for operation under severe environmental conditions.



Optional "quench" arrangement will stop the reed within three cycles after it has correctly identified its tone signal. This permits the high speed of operation required for mobile tone teleprinter and data transmission applications.

S. A. Armstrong Ltd., Toronto. (124)

Gauge measures organic finish thickness

The Boonton film gauge type 225-A can be used to measure the protective coating thickness of anodic films on anodized aluminum, magnesium, and other non-magnetic basis metals. These include such insulating films as organic paints, porcelain, enamel or other non-conductive coatings. To do this the following requirements must be met: the identity of the aluminum alloy beneath the measured finish must be determined; an area large enough to provide representative data must be measured; curvature of the surface must be minimal; the three feet of the gauge must rest flat on the surface.

Bayly Engineering Ltd., Ajax, Ont. (125)

High voltage power transistor

Type 2N296 p-n-p germanium alloy high voltage power transistor has been designed by Sylvania Electric for use in computer, telephone and aircraft circuits. It operates on 25 to 60 volts supply voltage and has a collector current of two amps.

Hackbusch Electronics Ltd., Toronto. (126

(Continued on page 46)

Generates five time markers

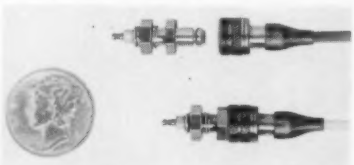
Type RM181 rack-mounting time-mark generator provides five time markers of 1, 10, 100, 1000 and 10,000 usec, and a 10 mc sine wave. Output amplitude is about 2 v. All six outputs are available at a common coaxial connector through use of a selector switch, and the five time markers are also available at front panel binding posts. The markers and sine wave are derived from 1 mc crystal-controlled oscillator with a frequency tolerance of about 0.03% and a short-time stability, after initial warm-up, of about 0.005% per hour. Dimensions are: 5¼ in. high, 19 in. wide, 9¼ in. rack depth (approximately 3 in. additional required for power cord), 11 in. over-all depth.

The generator is also available with a temperature stabilized crystal oven installed. Frequency stability is then 2 ppm over a 24-hour period.

Tektronix Inc., Willowdale, Ont. (127)

Snap-lock coaxial connectors

No pliers or special tools are required to operate these small snap-lock coaxial connectors. Holding action is by a spring-loaded retainer ring that engages in the groove of the receptacle. The centre conductor in each unit is recessed so that it cannot break, bend or short out against an airframe.



Frequency range of the connectors is 0 to 12 kmc and impedance values are 50, 75 and 95 ohms. Voltage breakdown is 1,500 v rms min. at one atmosphere and temperature range is —70F to +550F. The units will withstand vibration up to 10g at 10-3000 cps, and will take 100g shocks in any axis.

Electro-Physics Laboratories, San Marino, Calf. (128)

(Continued on page 47)

Eliminates relay

Trepac is a substitute for the line relay used in teletypewriters to isolate the selector magnet from the incoming loop. It is approximately the size of a 255A type relay. It incorporates a silicon rectifier which develops 60 ma dc to operate the magnet. This current is keyed on-off by means of a power transistor in accordance with the incoming signal. Trepac accepts either polar or neutral keying at nominal currents of either 20 or 60 ma.

Tele-Radio Systems, Toronto. (129)

Material absorbs microwaves

Highly expanded polystyrene treated to give a specific attenuation absorbs microwaves and can be used for lining radar darkrooms. The material is supplied in rigid blocks 15 in. square and 4 in. thick. Types AF10 and AF11 are primarily intended for operation over the frequency range of 2,500 to 50,000 mc. Type AF20 operates over the frequency range of 2,500 to 70,000 mc with improved performance at high angles of incidence.

Lake Engineering Co. Ltd., Scarborough, Ont. (130)

Sub-miniature clutches and brakes

Magtrol hysteresis and friction clutches and clutch brake combinations are now being manufactured in Canada. These are designed for use as actuators on missiles, tape tension controls on computers, winding and process tension controls in other applications.

Also available is a line of dynamometers for fractional hp motors of all types including shaded pole, torque meters, and speed indicators.

Found Bros. Aviation Ltd., Malton, Ont. (131)

(Continued on page 48)

Stereo tape recorder

The Tandberg Model 3-266 stereophonic system consists of two matched speakers in enclosures and a stereo tape recorder/reproducer with amplifier. It can be used to play back stereo tapes, half-track monaural tapes or full-track monaural tapes. It will record half-track monaural tapes on the uppper track only.

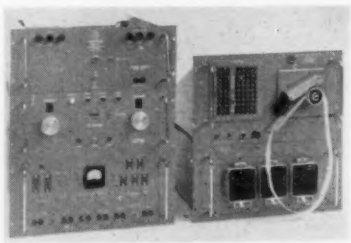
Frequency response at the three tape speeds is 30 to 17 kc at 7½ ips; 30 to 10 kc at 3¾ ips; 30 to 5 kc at 1⅞ ips. Equalization is according to NARTB. Playback of precordered tapes is within ±2 db at all frequencies. There is automatic equalization change for each speed in the recording amplifier as well as both playback amplifiers. Inputs include a microphone at 1 megohm, phonograph or radio at 500 k.

Engineered Sound Systems Ltd., Toronto. (132)

Electronic Circuit Tester Is Tape-programmed.

Model 180 circuit tester is tape operated and can be programmed to energize equipment under test, provide warm-up delay periods and stop when the operator is to perform an operation, and can be supplied with an accessory printer to provide permanent record of tests. The tests are performed on a go/no-go basis according to the information punched into the standard one-inch paper or paper-mylar tape.

For each measurement, any two test points designated on the tape are selected from 300 test leads by a crossbar switching unit. Additional switching units can be added in series to increase capacity beyond 300, or added in parallel to select four or more test points at one time.



Internal bridges and standards provide the following ranges: impedance, 10 ohms to one megohm; resistance, 10 ohms to 10 megohms, dc voltage, one volt to 1000 volts, ac voltage, 2.5 volts to 750 volts; continuity 0.5 ohms with 100 ma test current; leakage, 10 megohms to 500 megohms with 100, 250, or 500 volts dc applied. Ranges can be extended and more involved tests made.

California Technical Industries, Belmont, Calf. (133)

(Continued on page 54)

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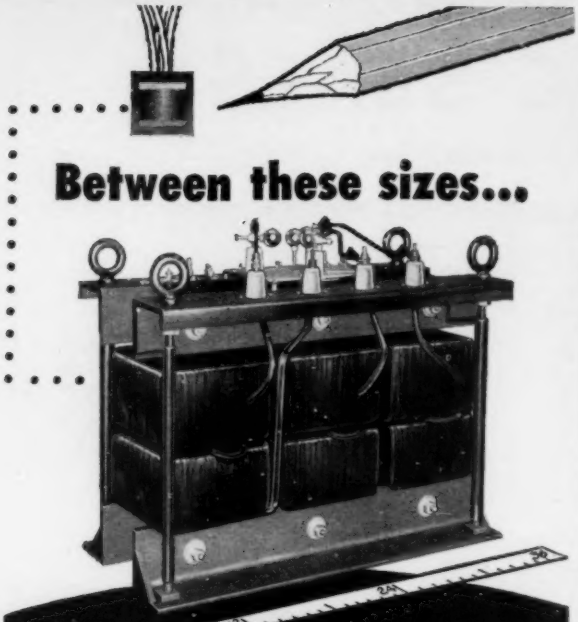

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STANDARD ITEMS STOCKED BY LEADING JOBBERS FROM COAST TO COAST

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Circle No. 28 on Reader Service Card

multi-range multi-purpose

automatic cut-out

20,000 ohms/volt d.c.

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The multi-range instrument with automatic cut-out protection for overload . . . just reset and carry on reading.

OTHER FEATURES:

4 Current Ranges:
100 mA. to 10 Amperes A.C.

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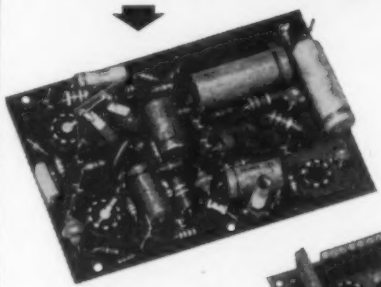

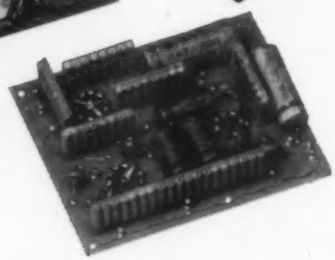

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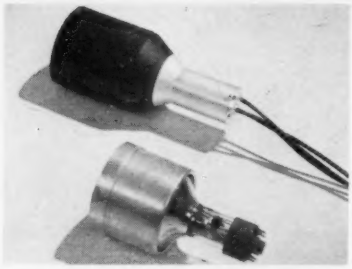
Scintillation transducer mounts crystal on photomultiplier

Thallium-activated sodium-iodide crystals in lengths up to four inches are integrally packaged with standard 5 in. photomultiplier tubes to provide high resolution scintillation transducers. They are housed in mu-metal magnetic shields complete with preamplifiers. The crystals can be provided with truncated conical ends, drilled wells or other configurations as desired.

Levinthal Electronic Products Inc., Palo Alto, Calif. (134)



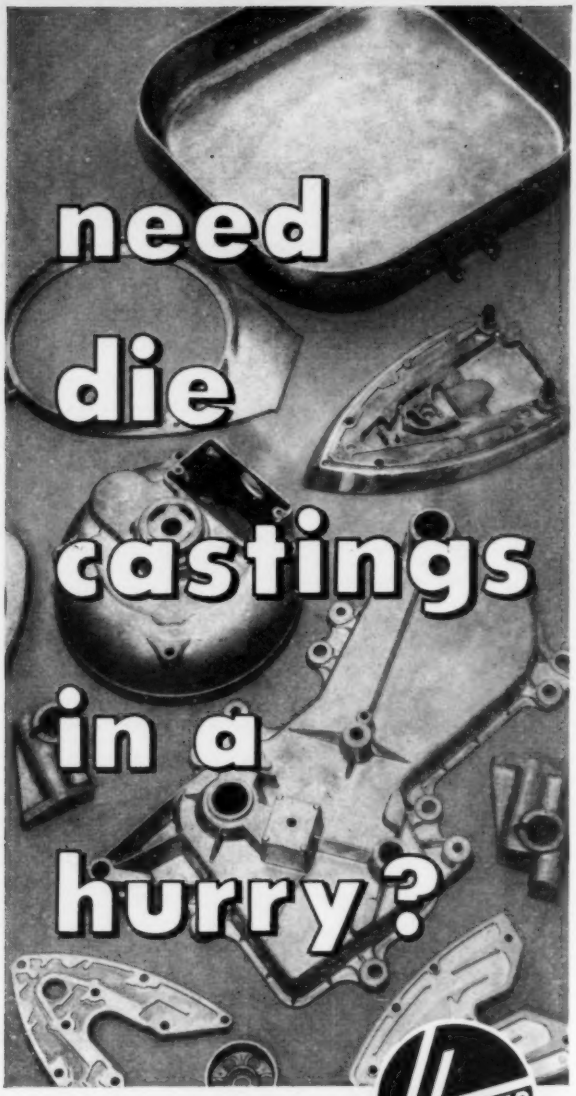
Instrument check fm/fm telemetering systems

Model TDC-5 simultaneous five-point calibrator and dynamic checker furnishes five deviation frequencies for each channel simultaneously as outputs for discriminator calibration and for multipoint calibration of subcarrier oscillators. Deviation frequencies may be set at whatever points desired; for example, +7.5%, +3.75%, 0%, —3.75%, —7.5%. Each frequency is crystal controlled to within ±0.02%. Operation may be automatic, semi-automatic or manual. On automatic, frequencies are stepped sequentially for all channels included in the system.

As as dynamic checker, a stepped fm wave is generated for each subcarrier discriminator. If the stepping rate is increased beyond the permissible information rate, marked harmonic distortion of the stepping frequency is detected on the screen of the spectrum analyzer. By adjusting the cycling rate of the TDC-5, which is continuously variable from 2 to 2,000 cps, until a clear picture is obtained, the maximum information capacity of each channel may be established.

Panoramic Radio Products, Inc., Mount Vernon, N.Y. (135)

(Continued on page 56)



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Now you can get fast delivery with Canadian made relays. All standard types are available and all are electrically and mechanically interchangeable with other makes.

Illustrated are only a few telephone type relays. Other spring and coil combinations are available.

For full information call or write Jack West, Sales Manager, Rectronic Division, **Canadian Line Materials Limited, Toronto 13, Canada.**

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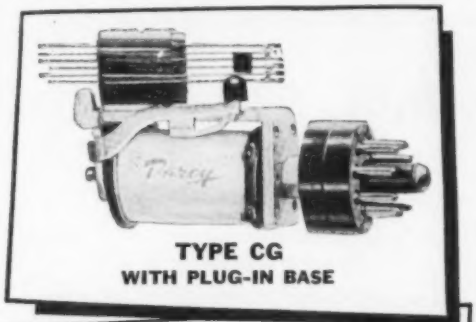
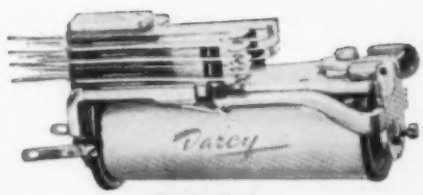


TYPE CG
WITH PLUG-IN BASE



TYPE CC

CLM

CLM-DARCY RELAYS

Circle No. 17 on Reader Service Card

New products—cont.

Fog detector measures the visibility

This automatic fog detector emits a concentrated beam of light which is slowly revolved and measures the amount of light returned by reflection of water droplets. It measures the visibility in terms of distance and gives a continual graphic record as well as operating fog signals and other alarms when visibility falls below a preset level and switches those signals off when it rises above another level. At regular intervals the equipment gives itself a complete systems check during which it automatically compensates for any changes in characteristic such as dirt on the lenses, or if a fault has occurred switches itself off and operates a false alarm signal.

Decca Radar (Canada) Ltd.; Toronto. (136)

70 kmc band microwave rat race

Rat race microwave hybrid type MA-606 for use in the 68.0 to 73.0 kmc band has an isolation in excess of 20 db over the specified band width. It is a power divider useful in microwave systems wherever exact power division with negligible cross talk is required. When used in conjunction with two mixer crystals the assembly will perform as a balanced mixer. VSWR is 1.25 max and balance is ½ db.

E. G. Lomas Co., Ottawa. (137)

Advertisers' Index

Does industry make full use of its technical writers?

The technical writer can be an important member of any research or engineering team provided management will recognize and use his skills. How to make full use of writers in such an organization was one of the problems discussed at the national convention of the Society of Technical Writers and Editors in New York. The three-day convention brought together leading technical writers and editors from all parts of North America to discuss organizations, techniques, training methods and other problems. The predominating feeling among delegates was that industry failed to recognize and make full use of the many services that the technical writer can offer.

The present organization represents a merger of the Society of Technical Writers and the Association of Technical Writers and Editors. The first president of STWE, elected at the convention, is Irving H. Jenks, head of the Division of Publications and Documents, Aluminium Laboratories, Ltd., Kingston, Ontario.

The objectives of the Society are to: develop and establish standards and a code of ethics; stimulate and exchange ideas, knowledge, philosophy and techniques; encourage professional development and training; acquaint others with the profession. To do this they have established a number of local sections to hold regular meetings and undertake training or workshop projects.

Chapters have been established in Montreal and Ottawa to serve eastern Ontario and Quebec.

KCS Data Control expand fast

The opening of their new building last month was a milestone for KCS Data Control Ltd. In October 1954 three men from the computation centre at the University of Toronto each dropped $750 into the pot to start operations in a small 10 ft. x 12 ft. Bay St. office. Now J. Katz, L. Casciato and J. Shapiro have added a fourth partner, Prof. B. A. Griffith, 36 full time staff members and six associates who are specialists in various fields of mathematics, statistics, engineering, economics, etc.

Open new office

The facilities of KCS were displayed to the public at the recent opening of their new office building in Toronto. To do the actual computation work, they have two computing installations —an IBM 650 and a Royal McBee Librascope. With these goes all the auxiliary equipment such as card punchers, sorters and printers.

The company, however, specializes in solving problems where the computer can be used as a tool to speed the work. Typical of the projects are engineering calculations for the cut and fill required on new roads for the Ontario Department of Highways. On some of the work, as much as two thirds of the engineering time can be saved by the computers.

A.P.E.O. meeting

Next month about 1,000 of Ontario's 16,000 professional engineers will gather in Toronto for the annual A.P.E.O. meeting. Morning and afternoon sessions will hear reports from the chairman and the active committees. The date is February 1 and guest speaker is Dr. A. C. Posz, Michigan State University.

What was he doing? Kibitzers watch Dr. J. Katz, right, play a hand of black jack with a computer at KCS Data Control Ltd. ps: He won a cigar

J. Ridout, CGE and J. Simpson (r), Electronic Assoc. at STWE convention

The new Canadian oscilloscope

At the IRE Canadian show Bach-Simpson exhibited their Canadian designed and built oscilloscope. In next month's issue of CEE R. Wilton is the author of a paper describing the design and development of the instrument.

Following requests for further nomograms A. E. Maine has an article on Power Filter Design which will be of wide use to the design engineer. Also included in the February issue will be "An analog memory" by Walter Kozak of Canadian Westinghouse.

In this, and future issues, watch out for "News highlights" —giving the interpretation of the industry news that matters.

COMING EVENTS

January

27-28 AIEE - IRE Scintillation Counters Conference. Washington, D.C.

February

2-7 AIEE Winter General Meeting. New York.

20-21 AIEE-IRE-U of P Transistor & Solid State Circuits Conference. Philadelphia.

March

17-21 EJC Nuclear Congress. Chicago.

24-27 Radio Engineering Show & IRE National Convention. New York.

24-29 Fourth International Instrument Show. Caxton Hall, Westminster, London SW1.

April

14-16 AIEE-IRE-ASME Automatic Techniques Conference. Detroit, Mich.

signal generators

10 to 21,000 MC!

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With *-hp-* signal generators, frequencies are directly set and read on one dial. Output voltage is directly set and read. No calibration charts are required. Most *-hp-* generators offer internal pulse, FM or square wave modulation; some include external pulsing and FM'ing. New *-hp-* 626A (10 to 15.5 KMC) and 628A (15 to 21 KMC) offer 10 mw output, SWR 1.2.

-hp- signal generators outsell other signal sources by approximately 2:1. Engineers report the reasons are simpler operation, versatility, trouble-free performance, and exceptional value.

Instrument	Frequency Range	Characteristics	Price
-hp- 608C	10 to 480 MC	Output 0.1 μv to 1 v into 50 ohm load. CW, pulse or AM mod. Direct calibration.	$ 950.00
-hp- 608D	10 to 420 MC	Output 0.1 μv to 0.5 v into 50 ohm load. CW, pulse or AM mod. Direct calibration and crystal calibrator check	1,050.00
-hp- 612A	450 to 1,230 MC	Output 0.1 μv to 0.5 v into 50 ohm load. Pulse, CW or amplitude modulation to 5 MC Direct calibration.	1,200.00
-hp- 614A	800 to 2,100 MC	Output 0.1 μv to 0.223 v into 50 ohm load. Pulse, CW or FM modulation. Direct calibration.	1,950.00
-hp- 616A	1,800 to 4,000 MC	Output 0.1 μv to 0.223 v into 50 ohm load. Pulse, CW or FM modulation. Direct calibration.	1,950.00
-hp- 618B	3,800 to 7,600 MC	Output 0.1 μv to 0.223 v into 50 ohm load. Pulse, CW, FM or square wave modulation. Direct calibration.	2,250.00
-hp- 620A	7,000 to 11,000 MC	Output 0.1 μv to 0.223 v into 50 ohm load. Pulse, CW, FM or square wave modulation. Direct calibration.	2,250.00
-hp- 623B	5,925 to 6,575 MC; 6,575 to 7,175 MC; 7,175 to 7,725 MC	Output 70 μv to 0.223 v into 50 ohm load. FM or square wave modulation. Separate power meter and wave meter section.	1,900.00
-hp- 624C	8,500 to 10,000 MC	Output 3.0 μv to 0.223 v into 50 ohm load. Pulse, FM or square wave modulation. Separate power meter and wave meter section.	2,265.00
-hp- 626A	10,000 to 15,500 MC	Output 1 $\mu\mu$watt to 10 mw. Internal or external pulse, FM, or square wave modulation. Direct calibration.	3,250.00
-hp- 628A	15,000 to 21,000 MC	Output 1 $\mu\mu$watt to 10 mw. Internal or external pulse, FM, or square wave modulation. Direct calibration.	3,000.00

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